

N. XII
55147/B



Emanuel Mendes da Costa.

A28.

XVI

AA 4024

16 p.

56 p.

121 p.

1 p. (2 leaves between 92/93)
1 print. fold. plate
2 plates (1 is folding)

55147/B

8/50

16/90

7

51399

FOSSILS

Of all KINDS,

DIGESTED into a

METHOD,

Suitable to their mutual

Relation and Affinity;

WITH

The NAMES by which they were known to the ANTIENTS, and those by which they are at this DAY known: And NOTES conducting to the setting forth the NATURAL HISTORY, and the main USES, of some of the most considerable of them.

AS ALSO

Several PAPERS tending to the further Advancement of the Knowledge of MINERALS, of the ORES of METALLS, and of all other SUBTERRANEOUS PRODUCTIONS.

By JOHN WOODWARD, M. D. late Professor of Physick at GRESHAM COLLEGE, Fellow of the College of PHYSICIANS, and the ROYAL SOCIETY.

LONDON:

Printed for WILLIAM INNYS, at the West-End of St. Paul's. M.DCC.XXVIII.

ROBERTS

OF NEW YORK

Directed into a

METHOD

Adapted to their annual

Revision and

WITH

The Method by which they were known
to the world, and the principles
of the art, and the manner of
teaching it, and the manner of
the manner of teaching it.

AS ALSO

Every Part of the art, and the manner of
teaching it, and the manner of
the manner of teaching it.

JOHN WOODWARD, M.D. &c. &c.
Author of the



Printed by J. B. Lippincott & Co., 151 N. 2d St., Philadelphia, Pa.



THE
P R E F A C E,

Giving some Account of the great
Plenty, Variety, and Excellence
of the subterranean Producti-
ons and Riches of ENGLAND.



*METALS and Minerals are
allow'd on all Hands, to be of
that high Value, and of that
Use in so many very important
Parts of human Life and Affairs, that
they merit, and justly challenge our ut-
most Study and Attention. The judicious
and intelligent Part of Mankind want
not a due Sense of this, and that a great*

Share of our Wealth and Strength, our Happiness and Security both at Home and Abroad, depend very much upon them. That a Considerable Part of this Island, I mean Cornwall, abounds in Tin, one of the most useful of them, has been known from the earliest Times. Nay, it has been a chief Branch of our Trade, one of our most profitable Manufactures, and for many Ages employ'd a multitude of Hands, to great Advantage for themselves and the Nation, that would otherwise have been wholly idle, in Want and Distress. The Lead of England is another main Fund of our Riches. The Ore of it is not only found here in great Plenty, but 'tis kindly and well condition'd, melts and obeys the Fire, and yields the Metall in it with less Fuel, Trouble and Expence, than any of the Foreign Lead-Ores that I know. Then, when separated, 'tis better, softer, more ductil, and fit for Use, than that of all other Countries. Which does not arise from any Peculiarity in the Metall; for the Lead of England, and that of Saxony, the Gold of Japan, and that of Brazil, the Silver

of

of Peru, and that of Norway; to be short, all Metall of the same Kind, when reduc'd to an equal Purity, is alike in every Respect, in what Country soever it be got; but because the Spar, and other extraneous Matter, incorporated with the English Lead in the Ore, happens to be of such Nature and Disposition as to be wrought upon easily, and freely to part from it. Nay, so much Iron and Copper hath been discovered of late Years, and so many Ways of working and extracting them newly found out, that we have now vast Quantities of our own to export and send Abroad, that were wont heretofore to import them at very considerable Charge. 'Tis but a few Years since Wad or Black-Lead was found out. Nor is there in all the whole Globe besides, the like Plenty, or any of near the Goodness and Worth of ours. The same may be said of the Coal that we have without Measure, and that is of such indispensable Use and Necessity in almost all our Affairs. Those large Masses of good Load-Stone found on Dartmoor, the Antimony of Cornwall, the Manganese of Mandip,

Mandip, and the Calamin, finer and better than any in the World besides, our Alum and Vitriol are further Instances of our Wealth under Ground. Many other Discoveries assuredly remain yet to be made, and Improvements in the Ways of working our subterranean Productions, managing them to better Advantage, and turning them to further Uses. Multa egerunt qui ante nos fuerunt, sed non peregerunt, multum adhuc restat operis, multumq; restabit, nec ulli nato post mille sæcula præscindetur occasio aliquid adhuc adjiciendi, *Seneca*. Those who have either little Capacity, and Command of Thought, or have it, and make little Use of it, will not be easily brought to believe to how great Purposes Things seemingly very slight may be made serviceable. For the Present, I will instance only in Fuller's-Earth; which England affords so very good, and in Quantity superior to that of any Country besides. Those who are not rightly acquainted with the Uses of this, and should only look into the Pits of it, that are at Wooborn, and in several other Parts of the Kingdom, would be
apt

apt to slight and despise it ; and very probably to laugh at any Man who should take upon him to set forth how precious a Commodity it is ; tho' in Truth, it be a Thing of much higher Advantage, and brings in a greater Revenue to this Crown and Kingdom, than the Delves of Diamonds in Golconda, the Silver Mines of Potosi, and the Gold of Brasil, bring into the great Mogul, the King of Spain, or Portugal. Those serve rather to reduce and impoverish the People, by rendring them proud and haughty, and consequently idle and vicious, than really to enrich and turn to their Benefit. Indeed their Neighbours wisely take the Advantage of their Sloth and Negligence ; and turn easily to their own Profit, what, want of Virtue and Industry in the original Proprietors let lye wholly unemploy'd and fruitless, while in their Hands. Our Ancestors were well aware of how great Benefit to the Nation Fullers Earth must needs prove. One main Property of it is to imbibe Oil, Grease, and all other like unctious Matter : 'Tis that Property that renders this Earth so
useful

useful in the cleansing Woollen Cloth, and freeing it from all those noisome and offensive Impurities. Every Body conversant in rural Affairs, must needs know how frequently Tar is of Necessity imploy'd; as also Grease and Tallow, in the Diseases and Affections that Sheep are externally so frequently obnoxious to: And besides, their Wool cannot be work'd, spun, or wove into Cloth, unless it be first well oil'd and greas'd. Now, all this must be taken out of it again, before it can be worn or turn'd to Use. Nor has there been any Thing ever yet found out so serviceable to that End, as this Earth. And, as the Fullers Earth of England is got in great Plenty, so it very much exceeds any hitherto found out Abroad in Goodness. Which is the chief Reason why the English surpass all other Nations in the Woollen Manufacture; and to preserve the Benefit of this to the Country, and secure it from the Usurpation of Foreigners, the Exportation of English Fullers-Earth is strictly prohibited by Act of Parliament.

What

What may serve further to incite our Diligence and Curiosity is, that some late Searches have shewn us many Things besides those already pointed forth, that were wont to be fetch'd from afar, nay in Plenty, and much greater Perfection, here at Home. We have Demonstration of this in the many large stately Masses of the blackest and most polite Jeat, discover'd so frequently on the Coasts of Yorkshire; in the beautiful fine Amber of Suffolk, and our other Shores. Then we have Jaspers, Cornelians, Agats, Mochoes, and Onyxes; as also Topazes, and Amethyfts, as fine, if not so hard, as the Oriental. Diamonds indeed we have none; nor Rubies, with some others of the Gemm-Kind. But, excepting these, and Cinnabar, I know not any Production of the Earth whatever, that I have not found in this our native Country; such is the Præeminency of the Soil of England! such its happy Fertility, and Abundance in all Kinds of subterranean Treasure. Nor need we go far for Proof of this, when my own Cabinets have

now actually in them (to pass by the Extraneous, which are in as great Numbers) above 2800 Native English Fossils, all different. So great a Number, got together by the Industry of one single Man, involv'd all the while in Multiplicity of other Business, cannot surely but shew that the Soil produces them in great Abundance. Which will be made much more apparent, whenever like Searches are undertaken in Earnest by one that has Leisure and Encouragement.

*But what crowns all is, a Man is here sure, when with great Charge, Labour, and Contrivance, he has once discover'd and obtain'd any Kind of this Treasure, to hold and enjoy it. In other Countries, the greatest Share falls to the Lord of the Soil, or the Prince of the Country: And he that studies and drudges for it, enjoys the least Part of it. This is a cruel Check and Discouragement to Search and Industry! But happy England is secure, and wholly exempt from this; which is all owing to the Virtue and Wisdom of our Ancestors, and to the Excellence of those
Laws,*

Laws, and that Constitution, which, at the Expense of so much Blood and Treasure, they got establish'd, and transmitted down intire to us their Posterity. By which Means we continue a free People, while not only our Neighbours all round, but almost the whole World besides, are under a Tyranny of one Sort or other; and subjected to the Lust, Ambition, Avarice, and Oppression of those who ought to be Fathers of their Country, and protect them in their natural Rights. So sacred a Tye, and high an Obligation do we, who are so sensible, and thorowly appriz'd of the Happiness of these Laws, and the Excellence of this Constitution, lye under to guard both with the utmost Zeal, Vigilance, and even Jealousy; to transmit them down intire and safe to our Posterity: To be true to that great Trust which our Forefathers have thus reposed in us; and never part with, or give up any the least Particle of this so fair and precious Jewel. If there be amongst us any of so clumsy a Frame, and so thorowly hard-headed, that they cannot, or so corrupt and blinded by other Interests, or so

sway'd and byass'd by wrong Maxims which they happen to be possess'd with, that they will not, be wrought upon by these Considerations, they cannot fail of being effectually convinc'd, if they please to look into what they will find set in a much better Light by Polybius, by Livy, by Tacitus: Or, if they please to compare the Condition of the Romans, while a free State, with that, while under the continually incroaching Power of their Kings and Emperors; or of the Athenians, and the other Grecian States, while they were under the Protection and Encouragement of their own Laws, with that, when under their Conquerors: To observe their then Grandeur, their Riches, and that all the more elegant and useful Arts and Sciences had their first Rise, and the Muses their Seat there; and compare that with their present Condition, their Meanness, their Poverty, and even astonishing Ignorance, cannot surely hesitate one Moment in deciding to what it is that Great Britain owes all its Happiness.

These

These things rightly weigh'd, with several others that might well be offer'd; had I not already too far transgress'd and exceeded my Bounds; and the many noble Products of England duly reflected on, 'twill hardly be possible for a Man to withhold himself from falling into the same Transport and Passion for this Country, that one of the greatest Wits of Italy, in his Time, Giovanni Cotta, did for his.

— Qui Te noverit
 Et non amarit protinus
 Amore perditissimo,
 Is, credo, seipsum non amat;
 Caretque amandi Sensibus,
 Et omnes odit Gratias.

For those therefore that, thus taken with these so useful, instructive and delightful Studies, may, of their Virtue, Good Sense, and Love to their Country, be ambitious of facilitating them, and of enlarging, and further displaying this so beautiful and charming a Scene, I shall, from my little Store, pick out such loose scat-

scatter'd Papers that, I judge, may contribute something to their Light and Direction; delivering them in the Order that follows.

NUMBER I. Fossils digested into a Method with Notes.

NUMBER II. In quâ, uno intuitu, conspiciuntur omnis Generis Fossilia, juxta ipsam naturæ Methodum, in Classes ordinata.

Letter. 1. NUMBER III. A Letter to Sir *Is. Newton*, sent along with the Method of Fossils, giving an Account of the Things needful and preparatory to the drawing up such a Method. The Difficulties of it and its Uses.

2 NUMBER IV. Letter to Sir *John Hoskyns* Baronet. The Study of Fossils never hitherto reduced to Rule, nor any Form of Art. The Writers, both the Antients, and those of later Times, have confounded Things buried in the Earth, with the natural constituent Parts and Productions of it. These distin-

distinguish'd, the Ranks of each adjusted, and *Fossils* divided into *Extraneous* and *Native*.

NUMB. V. Letter to the same. Of the *Ceraunia*, or *Stone-Weapons*, the *Magical Gemms*, and some other *artificial Things*, antiently in use, imagin'd by many Writers to be *natural*, with *Icons* of several of those in my Collection, brought from most Parts of the known World.

NUMB. VI. Directions for registering of the *Native Fossils*, and composing an instructive and useful Catalogue of them. *Numb. 4*

NUMB. VII. Letter to Monsieur—— at *Neufchattel*. The Assistance that this, and several other learned Men have given to the carrying on the Design of the *Natural History of the Earth*.

NUMB. VIII. To the same. Of the Origin, Nature and Constitution of the *Belemnites*. *6*

NUMB. IX. To the same. Of the *Coralloids*, digg'd up at Land: The Nature and Origin of them. *7*

VIII NUMB. X. Concerning Corall, Corallin, and other like Bodies form'd at Sea.

IX. NUMB. XI. Brief Instructions for making Observations and Collections; and for composing an *itinerant Register* of all things collected and observ'd. Of Searches on the Surface of the Earth, upon Mountains; and in the Bowels of it, in Grottoes, Pits, Mines, and Quarries. Of the Water in Mines: Of Steams there, presaging Changes of Weather: Of Damps, and other Meteors there. Of the Fogs, Mists, or Clouds, that hover over high Mountains before Change of Weather. Of the Peat-Marshes: And of the Trees, and other Things found buried in them.

NUMB. XII. An *Addition* to the second Part of the *Essay towards a natural History of the Earth*.

NUMB. XIII. A Mineral Dictionary; or an alphabetical Index of the Names of all Kinds of Fossils, referring to the Pages of this Work, wherein each is explain'd.

INDEX of Things *occasionally* treated of in these Papers.

A 110

THE UNIVERSITY OF CHICAGO
LIBRARY

THE UNIVERSITY OF CHICAGO
LIBRARY
110

THE UNIVERSITY OF CHICAGO
LIBRARY

THE UNIVERSITY OF CHICAGO
LIBRARY

T A B U L A

In quâ, uno intuitu, conspiciuntur omnis generis FOSSILIA, juxta Naturæ
METHODUM, in CLASSES ordinata.

FOSSILIA sunt.

1^o Opaca, insipida, friabilia; in aqua solubilia: flammam non concipientia; TERRÆ; ad Tactum

leves, & quasi sebaceæ; quæ Lingua, si illi admoveantur, adhaerent. CIMOLIA-PURPURASCENS. CIMOLIA-ALBA. ARGILLA. TERRA-SAMIA. TERRA-LEMNIA, tam RUBRA, quam ALBA. BOLUS ARMENA. KILLOIA. RUBRICÂ molliuscula. Non adhaerens. STEATITES. MOROCHITES, GALAXIA, seu LEUCOGRAPHIS. Scabra & Sicca. TERRA-VIRIDIS. TERRA-CÆRULEA. RUBRICA duriuscula. TERRA-TRIPOLITANA. KILLOIA duriuscula. TERRA-CARIOSEA. TERRA-MELITENSIS. TERRA-SINENSIS, e quâ Vasa porcellana dicta; sunt. OCHRA. TERRA-FLAVESCENS. UMBRIA. CRETA. STEINOMARGA. Geo. Agricola, quæ est Lac Lune Ol. Wormii. TERRA-NIGELLA, vegetabilis, Dædala. LUTUM, MARGA. S. Terra rubella, Zoica, Adamica. TERRA-MISCELLA.

Appendix. GLAREA, S. SABULUM. ARENA.

2^o Insipida, dura, non ductilia, nec in Aqua solubilia; LAPIDES; qui mole sunt

Majore, in Strata dispositi, compositionis laxioris, ad tactum scabri. LAPIS-MOLARIS. COS, tam GYRATILIS, quam PORTABILIS. SAXUM-ARENARIUM. SAXUM-SCABRUM. SAXUM SECTILE. SAXUM-CALCARIUM. SMIRIS. spissioris, ad tactum leves, qui; attritu aliquatenus politi sunt. LAPIS-FISSILIS. LAPIS-LYDIUS. COS-OLEARIA. COTICULA. dura & compactæ adeo, ut ad Nitorem poliri possint. ALABASTRITES. MARMOR, colorum variorum. OPHITES. PORPHYRITES. GRANITA.

Minore; Marmore.

Non duriores.

Figura & Constitutionis incertæ & indeterminatæ. ROTULÆ-LAPIDEE. GLOBULI-LAPIDEI, LAPIDES-BORBORI. SCHIRRI-LAPIDEI.

Figura extus variæ & incertæ, Constitutionis verò internæ determinatæ & regularis:

Compositi, e Fibris parallelis, quæ in horum plerisq; flexiles sunt, & vi elastica præditæ. GYPSUM-STRIATUM, Anglicum. AMIANTHUS sive ASBESTOS. ALUMEN-PLUMOSUM.

Compositi e Laminis præsertim planis & parallelis, quæ flexiles sunt & vi elastica præditæ. TALCUM. MICA G. Agricola, argentea seu alba, uti ac aurea, & nigra.

Qui, interpositione laminarum è Materia ad Fluores dictos potissimum accedente constantium dividuntur in Talos, seu partes angulares, pentagonas, seu hexagonas, aut alias cujusvis figuræ angularis. LUDUS HELMONTII.

Fistulosi, ex Tubulis eadem etiam Materia constantibus compositi. LAPIS-SYRINGOIDES.

Compositi è Crustis altera alteri superinductis;

 { arte coherentibus nullâ intus Cavitate. BEZOAR-MINERALE.

 { intus cavi, cum Materiâ quadam inclusâ, Crustæ non adhaerenti; sed mobili; Solidâ, & lapideâ; veteribus Callimus dictâ. ÆTITES-SILICEUS. ÆTITES-CHREO-FERREUS.

 { laxa; uti Arena, Ochra, Creta, Terra, GEODES.

 { liquidâ, ENHYDROS.

Figura & Constitutionis, certæ, regularis & determinatæ, SELENITES. LAPIS-SPECULARIS. BELEMNITES, seu Lapis Lyncis, Lyncurius forte veterum. Corpora CORALLOIDEA-FOSSILIA, tam simplicia, quam ramosa. Lapides Coralloidibus Fossilibus affines STELECHITES. MYCEITES. PORPITES. ASTROITES. LAPIS-FAVAGINOSUS. FLUORES, figurati, CALGUM. CRALBUM. STALACTITES. STALAGMITES. OSTEOCOLLA.

duriores;

Opaci, plerumq; unicolores. LAPIS-NEPHRITICUS. MALACHITES. PRASITES. IASPIS-RUBENS ægyptius, variorum in eodem corpore Colorum. LAPIS-LAZULI, seu Cyaneus. HELIOTROPIUM. IASPIS.

Semipellucidi;

 { versicolores, prout vario situ luci obijciuntur, OCLUSUS-CATI. OPALUS.

 { coloribus in subiecto permanentibus CALCULI, aliquot & SILICES COMPACTIONES & ELEGANTIORES. ACHATES. LAPIS CALCEDONIUS. ACHATES MOCHOENSIS. OCLUSUS-BELL. ONYX. SARDONYX. LAPIS-SARDIUS, seu CARNEOLUS vulgarior, CARNEOLUS-ALBUS: item LUTEUS, qui rarissimus. BERYLLUS GEMMARIORUM, qui Carneoli species est magis pellucidi, & saturatius rubentis.

Pellucidi:

 { colorati: TOPAZIUS Recentiorum, qui Chrysolithos, Veterum. HYACINTHUS, Gemmariorum. LAPIS-GRANATUS. RUBINUS Rupium. Rubinus BALASSIUS. Rubinus SPINELLUS. CARBUNCULUS recentiorum, Rubinorum species rarissima. AMETHYSTUS. SAPPHIRUS, tam saturatè quam pallidè cærulea, quæ SAPPHIRUS-AQUEA dicitur. Gemma Italis AQUA-MARINA dicta, quæ forte BERYLLUS Plinii. SMARAGDUS. CHRYSOLITHUS Recentiorum, qui Topazius Veterum. coloris expertes. CRYSTALLUS. SAPPHIRUS-ALBA. ADAMAS.

3^o Friabilia, aliquatenus pellucida, linguam pungentia, in Aqua solubilia, ea autem evaporatâ, denuo coalescentia & in Figuras angulares se componentia. Salia. (§) SAL-FOSSILE, tam RUPEUM quam GEMMEUM. Sal Cyrenaicum seu AMMONIACUM. TINCAL Persarum, quod videtur CHRYSOCOLLA esse Veterum. NITRUM Ægyptiorum veterum, recentiorum NATRON, seu LATRON. NITRUM recentiorum. SAL-ACIDUM fossile, è quo, cum Materiâ bituminosâ, cretaceâ, vel metallicâ, coalescente, oriuntur SULPHUR, ALUMEN, & VITRIOLUM.

4^o Flammam facile concipientia & Oleum præbentia, in Aquâ non solubilia; Bitumina;

 { Liquida. NAPHTHA. PETROLEUM. OLEUM TERRÆ BARBADENSE.

 { Solida. BITUMEN. PISSASPHALTON. SUCCINUM. GAGATES. Lapis AMPELITES. LITHANTRAX.

5^o Metallis affinia, quibusdam scilicet Metallorum Proprietatibus prædita, Pondere saltem & Splendore;

 { Fluida. ARGENTUM-VIVUM-NATIVUM.

 { Solida, igne fusilia, sed non ductilia, CINNABARIS. ARSENICUM aureum. ARSENICUM RUBRUM, seu SANDARACHA. PYRITES. MARCASITA. COBALTUM. LAPIS-CALAMINARIS. ANTIMONIUM. BISMUTHUM. SPELTRUM. NIGRICA-FABRILIS.

6^o Ponderosa, Splendentia, solida fusilia, & ductilia; Metalla. (§) AURUM, ARGENTUM. CUPRUM. FERRUM. STANNUM. PLUMBUM.

Appendix ad Cap. de Ferro. HEMATITES, S; SCHISTOS, MAGNES, MAGNESIA, ferri plus minus in se continent.



A

Methodical Distribution

O F

FOSSILS,

Of all Kinds, into their proper

CLASSES,

Viz. 1. Earths, 2. Stones, 3. Salts, 4. Bitumens, 5. Minerals, 6. Metalls.

Class I. EARTHS,



R Bodies opake, insipid, and, when dryed, friable, or consisting of Parts easy to separate, soluble in Water; not disposed to burn, flame, or take fire.

B

CA-

2. *A Method of Fossils.*

CAPUT I. Those that, to the Touch, have a Smoothness like that of unctuous Bodies.

MEMBR. I. SUCH as, if applied to the Tongue, adhere to it. FULLERS-EARTH (1). TOBACCO-PIPE-CLAY (2). POTTERS-CLAY (3). The SAMIAN BOLE, and the LEMNIAN, both the red and the white; BOLE-ARMENIAC (4). The softer KILLOW (5), the softer *Ruddle*, or, as 'tis call'd in the North, SMITT (6).

MEM-

(1) *This is call'd by some Writers, Cimolia purpurascens.*

(2) Cimolia alba.

(3) Argilla.

(4) *These astringent Earths take their Names from Samos, Lemnos, and Armenia, the Countries from which we have them.*

(5) Killoia molliuscula. Killow is found in Lancashire, and mentioned by Dr. Merret in his Pinax. 'Tis of a blackish or deep

blue Colour, and, doubtless, had its Name from Kollow, by which Name, in the North, the Smut, or Grime, on the Backs of Chimneys, is call'd

(6) Rubrica molliuscula. A sort of Earth of a dusky red Colour, found chiefly in Iron Mines, the finest in those of Langron in Cumberland. Some of this Earth contains as much Iron as to render it worth smelting.

MEMBR. 2. SUCH as will not adhere to the Tongue. SOAP-EARTH (6*), FRENCH-MARKING-STONE (7).

CAP. 2. Those that, to the Touch, are dry, harsh, and rough. TERRE VERTE (8). TERRE BLEUE (9). The harder RUDDLE (10). TRIPOLY (11). The harder KILLOW (12), or *Marking-Stone*. ROTTEN STONE (13). MALTESE-EARTH (14). CHINA EARTH (15). of which the fine Earthen-ware of *China*

B 2

and

(6*) *Steatites.*

(7) *This probably is the Moloichites of Pliny: and the Moroethus, Galaxia, and Leucographis of Dioscorides. It is unctuous to the Touch, as the former is, but harder and nearer approaching the Consistence of Stone. The French call it Craye de Briançon.*

(8) *Terra Viridis. This owes its Colour to a slight Admixture of Copper.*

(9) *So does the Terre bleue, which is no other than a light, loose, friable Kind of Lapis Armenus.*

Terra cœrulea.

(10) *Rubrica duriuscula. This owes its Colour to an Admixture of Iron: And as that is in greater or less proportion, the Body has a greater or less specific Gravity, and Consistence, or Hardness.*

(11) *Terra Tripolitana.*

(12) *Killoia duriuscula. This Dr. Merret calls Lapis cœruleus duccendis Lineis idoneus.*

(13) *Terra cariosa.*

(14) *Terra Melitensis.*

(15) *Terra Sinensis.*

and Japon is made. Yellow-OCHRE (16).
 GHALOLINA (17). UMBRE (18).
 CHALK (19). The STEINOMARGA (20).
 The BLACK-EARTH, every where obvi-
 ous on the Surface of the Ground, which
 we call MOULD (21). Garden-Earth, or Un-
 der-Turf-Earth. Common CLAY (22*).
 MARL (22). LOAM (23).

APPEN-

(16) Ochra.

(17) Earth of a bright
 Gold Colour, found in the
 Kingdom of Naples, very
 fine, and much valued by
 Painters. Terra flavescens.

(18) Umbria.

(19) Creta.

(20) Steinomarga Agri-
 colæ de Nat. Fos. L. 2.
 p. 578. Agarico minerale
 Fer. Imperati Hist. Nat.
 L. 5. c. 41. Lac. Lunæ Ol.
 Wormii Mus. L. 1. §. 1.
 c. 4. This, when pure, is
 soft, light, and very white.
 'Tis frequently found in
 Form of a white farinate-
 ous Powder, but sometimes

concreted into a Mass, soft,
 fungous, and not unlike
 Agaric. When there is a
 small Proportion of a sparry
 or arenaceous Matter in-
 corporated with it, it ren-
 ders it gritty and friable.

(21) Terra nigella ve-
 getabilis Dædala. Concer-
 ning this see the Introdu-
 ction to the natural Histo-
 ry of the Earth.

(22*) Terra rubella,
 Zoica, Adamica. Lutum.

(22) Marga.

(23) This is only Marl
 or common Clay, with a
 small Admixture of Sand
 in it. Terra Miscella.

APPENDIX to Class I.

GRAVEL (a) and SAND (b).

THESE do not properly belong to this Place; yet, in compliance with the common Method of the Writers of Fossils, I shall mention them here; and at least point forth what they are.

(a) GRAVEL, *Glarea, Sabulum*, consists of *Flints*, of all the usual Sizes, and Colours; of the several sorts of *Pebles*; sometimes with a few *Pyritæ*, and other *Mineral Bodies*, confusedly intermix'd; and common *Sand*.

(b) SAND, *Arena, ἄμμος, ἰάμμος*. Under this Title we have four Sorts of very different Bodies, *viz.*

I. *Extremely small Pebles*, many of them white, several pellucid, some yellow, red, and of other Colours. These constitute the true, which is indeed our
common

6 . *A Method of Fossils!*

common Sand; this being found in the *Gravel-pits* all over *England*, and particularly in those about *London*, in the Sand-Pits of *Hide-Park*, those about *Kensington*, those near *Woolwich*, and upon *Blackbeath*. Our Microscopes shew it to be only a *Congeries* of such small *Pebles*. The same sort of *Sand* is also found on the *Shores* of the *Sea*, and *Rivers*; 'tis here commonly very clean and fine, the Waters serving to wash, clear, and free it from Earth, Clay, Mud, and other lighter Matter; and, by that Means, to bare and uncover the *Sand*, whenever the Earth there contains any in it.

2. *The Gritt of Stone*, or Matter, of that sort of which the *Strata* of Stone are composed, found lying loose. Part of this, by reason of the Intermixture of Matter with it, that was earthy, lax, and incapable of Coalition, has not been consolidated, but lay ever loose, and in the State in which it is now found. The rest is such as has by little and little moulder'd down after Frosts; and been beat off, from the *Strata*, by the Falls of Rain, or, where

where it happens to be near them, by the Waves of the Sea, and Rivers. 'Tis found chiefly on the Sides, and at the Bottoms of Rocks; and on the Shores of the Sea and Rivers.

3. *A brittle Shattery sort of Spar*, found, in Form of a white Sand, chiefly in the perpendicular Fissures, amongst the Ores of Metalls.

4. *Small Fragments of Shells*, broken, and reduced into Form of Powder, by Means of Stones, and other ponderous hard Bodies, agitated by Tides and Storms. This is found in vast Plenty on some Shores, and is frequently made use of for the manuring of Land, by the Name of *Sea-Land*. See the *Reflections concerning Vegetation*, *Philosoph. Transact.* N^o. 253.

Class 2. STONES.

OR Bodies insipid, hard; not ductile, or malleable; nor soluble in Water.

8 *A Method of Fossils.*

CAPUT I. Those which are found in great Masses, and formed into *Strata*.

N. B. *The Characteristic of the Bodies in this Chapter, I mean, their being formed into Strata, does not hold so universally, but that there are small Deviations from it. Thus sometimes, Marble is found, not in Strata, but in the perpendicular Fissures of them; which Alabaſter likewise is, in some Places, and indeed even a fine Stony Matter, as also an Earthy, e. g. Um-bre, and Ochre. On the contrary, Mineral and Metallic Matter, found most commonly in the Fissures, is sometimes likewise found in the Strata, e. g. Spar, Iron, Copper, and the like. Nor can this be thought strange, to any one that rightly reflects upon the Confusion that these Bodies were in, after the Dissolution that befell them during the Deluge; and upon the Transitions and Removes that are made by Water passing the Strata into those Fissures. Vid. Nat. Hist. Earth. Part 2 and 4. But this whole*
Affair

Affair will be set in a Light more clear, full, and distinct, whenever the Catalogues of my Fossils, both English and Foreign, shall come forth.

MEMBR. I. SUCH as are of a Composition more lax, and a Grain more coarse, or rough, to the Touch. MILL-STONE (24). GRIND-STONE (25). WHET-STONE (26). SAND-STONE (27). RAG-STONE (28). FREE-STONE (29). FLAG-STONE

C

STONE

(24) Lapis molaris.
 (25) Cos gyralis.
 (26) Cos portabilis.
 (27) Saxum arenarium.
 (28) So named from its breaking in a ragged, uncertain, irregular Manner. Saxum Constitutionis du-

rioris, crassioris Scabrae.
 (29) So named from its being of such a Constitution as to be wrought and cut freely, in any Direction. Saxum Sectioni in omnem Partem, & directionem, ex æquo cedens.

10 *A Method of Fossils!*

STONE (30). LIME-STONE (31). *Polishing Stone*, or EMERY (32).

MEMBR. 2. Such as are commonly of a closer Composition, and somewhat finer Grain, so as to be more smooth to the Touch, and in some small Degree capable of a Polish. SLATE (33). TOUCH-STONE (34). OIL-STONE (35). The HONE (36).

MEM-

(30) Saxum laminosum
'Tis call'd commonly Slate, merely because 'tis us'd, and indeed very fitly, like Slate, for the covering of Houses, particularly at Bath and in several Parts of the West. But it will not split, as Slate does, being found form'd into what they call Flaggs, or thin Plates; which indeed are no other than so many Strata. I have observ'd of them, betwixt Castleton and Worksworth, in the Peake of Derbyshire, and in some other Places, from the Thickness of Paper, thro' all Degrees to a very considerable Bulk. They increase descending, the thickest lying ever

deepest in the Earth. All the Strata of our Globe are compiled of terrestrial Matter subsiding from the Water of the Deluge: and, when the Subsidence first began, that Matter was in greatest Quantity; so that the Strata that lye deepest, must of Course be the thickest; and must grow gradually thinner, ascending towards the Surface of the Earth, as the Water became more and more disengag'd of it.

(31) Saxum Calcarium.

(32) Smiris.

(33) Lapis fissilis.

(34) Lapis Lydius.

(35) Cos Olearia.

(36) Coticula.

MEMBR. 3. Such as are of a Constitution so hard and compact, and a Grain so fine, that they will readily take a bright Polish. ALABASTER (37). MARBLE (38) of divers Colours, both simple and mix'd, and found in several Countries, whence it has obtained several Names, which will be too tedious, and indeed of little Use to recite here. The OPHITES (39). PORPHYRY (40). The GRANITE (41) of the *Italian* Writers.

C 2

CAP.

(37) Alabastrites.

(38) Marmor.

(39) *The Ophites of the Moderns has a dusky greenish Ground, with Spots of a lighter Green, oblong, and usually near Square. The Ophites of the Antients, was little if at all different, as appears from the Fragments of it still remaining in Antient Works. Besides, Pliny's Account agrees well with this. He calls it also Memphites from Memphis in Egypt, near which City 'twas got. Plin. Nat. Hist. L. 36. c. 7.*

(40) Porphyrites.

(41) Granita. *This is the Syonites and Pyrrhocæcilus of Pliny, Nat. Hist. L. 36. c. 8. which, according to his Intelligence, was got near Syene in Thebais. He observes, and indeed very rightly, that the Egyptian Obelisks are made of this. V. M. Mercati de gli Obelisch di Roma, c. 2. p. 4. It has been long a Doubt, amongst the Learned, where so great a Quantity of Porphyry and Granite, as we see in the works of the Antients, yet extant, in Syria, Phœnicia, Greece, and Italy,*
was

CAP. 2. Those which are found in smaller Masses.

MEMBR. 1. Such as do not exceed Marble in Hardness.

ARTICULUS 1. That are both of a Figure and a Texture that is uncertain and undeterminate. Those call'd *RUBBLE-STONES* (42). *Copple-Stones,*

was all digg'd up. But I have learned from the late Observations and Travels of Mr. H. Worsely, and since of Mr. Tho. Shaw, Lett. Dec. 20. 1725. and of some other curious and intelligent Persons, that there are many vast Strata, and even whole Rocks, consisting intirely of these two Kinds of Marble in Arabia Petræa. Whence these might be easily carried across the Red-Sea into Egypt; and, by the Mediterranean, into Phœnicia, Greece, and Italy.

(42) *Rotulæ lapideæ.*
The Water, at the latter End of the Deluge, depar-

ting in Hurry, and with great Precipitation and Violence, bore with it, not only the looser terrestrial Matter, but the Nodules and harder; nay, it tore up the very stony Strata, broke them, rowl'd, and tumbled along the Pieces and Fragments frequently very far from the Places where they originally lay, rounded, smoothed them, and brought them to Form of Nodules. They owe their Name, Rubble, to their being thus rubb'd and worn. These we find, in such Countries where there is Stone, frequently in great Numbers, and of

various

Stones, or BOWLDER-STONES (43).
CLAY-STONES (44). The *Stony Nodules*
 found lodg'd in the *Strata*, and call'd by
 the Workmen **KNURS** and **KNOTS** (45).

ARTIC.

various Sizes, in digging just within the Surface. But there are in many places, in Wales, in Cornwall, and elsewhere, Masses of Stone, sometimes to a vast Bulk. e. gr. of one, two, or more Tuns, thus torn up, and left at the Surface; of which I intend a further Account in its Place.

(43) *Globuli lapidei.*—
These are found on the Shore: of the Sea and Rivers: are Lumps and Fragments of Stone or Marble, broke from the adjacent Cliffs, rounded by being bowl'd, and tumbled to and again by the Action of the Water. Whence they obtain'd the Name of Boulder Stones; they being form'd by an Action like that of a Bowl, and thereby reduc'd to the Shape of one. Neither the Bowlders, nor Rubble-Stones, are ever invested with an exterior stony Crust or

Skin. 'Tis plain, from Consideration of the Manner of their Formation, they cannot. This is one Mark by which they are distinguish'd from Flints, Pebles, and the other native Nodules, that were form'd before the Subsidence of the Matter of the Strata, and are cover'd with such a Crust or Skin, unless it have been worn off by their having been, since their Formation, likewise so agitated and worn.

(44) *Lapides borbori.*

(45) *Schirrhi lapidei,*
From their being, as Knots in Timber, commonly harder than the rest of the Mass of the Strata, wherein they are found repositied, whether that be of Chiver, Slate, or Stone, in each of which they are found usually few in Number, of different Size, Substance and Shape, but commonly approaching a Globular.

ARTIC. 2. That are *external-ly* of Figure various and uncertain; *but, internally*, of a Texture determinate and regular.

SECTIO 1. Those which are composed of *Fibres*, which are parallel, and which, in most of them, are flexible, and elastick. ENGLISH TALC (46), of which the coarser Sort is call'd *Plaster*, or PARGET (47), the finer, SPAAD (48), EARTH-FLAX (49), or *Salamander's Hair*.

SECT. 2. Those which are composed of *Plates*, that are generally plain and parallel, and that are flexible and elastick. TALC (50). *Cat-Silver*, or GLIMMER (51), of which there are three Sorts, the *Yellow* or *Golden*, the *White* or *Silvery*, and the *Black*.

SECT.

- | | |
|--|------------------------------------|
| (46) Gypsum Striatum | filius Straboni L.90 Geogr. |
| (47) Gypsum. | (50) Talcum. |
| (48) Spatum. | (51) Mica Geo. Agri- |
| (49) Amianthus, or
Asbestos. Lapis Carysli- | colæ, aurea, argentea, ni-
gra. |

SECT. 3. Those which, by the Interposition of *Laminae*, or Plates, consisting of a Talky Spar, are divided into Tali, or angular Parts, as Pentagons, Hexagons, or of some other angular Figure. The WAXEN-VEIN (52) of Dr. Grew. *Catal. Mus. Soc. Reg. Lond.*

SECT. 4. Those which are fistulous and composed of *Pipes*, consisting of a like Talky Spar. The PIPED-WAXEN-VEIN (53) of Dr. Grew. *Ibid.*

SECT. 5. Those which are composed of *Crusts* including one another.

SUBDIVISIO I. Having the *Crusts* adhering close to each other, ordinarily to the Center of the Body, without any Cavity within. MINERAL BEZOAR (54).

SUB-

(52) Ludus Helmontii.

(53) Lapis Syringoides.

(54) *Of the Bezoar Minerale*, see P. Bocccone's *Recherches & Observ.* Nat. 8°.

SUBDIV. 2. Having a Cavity within, containing in it Matter, not adhering to the Crust, but loose and moveable.

§ § §. 1. Solid and Stony, call'd by the Antients *Callimus*. The FLINTY-EAGLE-STONE (55). The OCHREOUS-EAGLE-STONE (56).

§ § §. 2. Lax; e. gr. Sand, Ochre, Chalk, Earth; the ELFS-EARTH-SCRIP (57).

§ § §. 3. Liquid; the FAIRY'S-WATER-BOTTLE (58).

ARTIC. 3. That are of a certain, regular, and determinate Figure, and Constitution. The Rhomboidal
SELE-

(55) *Ætites Silicius.*

(56) *Ætites Ochroferreus.*

(57) *Geodes.* There's one sort of this found commonly among the clay us'd for making Tyles and Bricks; which the Work-

men call Race or Rance. The German Mineralists give it the Name of Erdmangen, or Earth-man.

(58) *Enhydros.* Ad motum, fluctuat intus in eo, veluti in ovis, liquor, *Plin.* xxxvii. 12.

SELENITE (59). MUSCOVY-GLASS (60).
 The THUNDER-BOLT (61). The Fossil
 CORALLOID BODIES (62), both *simple*
 and branched. The Stones related to the
 Fossil Coralloid Bodies, e. gr. STELE-
 CHITES (63). The MUSROOM-STONE (64).
 The BUTTON-STONE (65). The STAR-
 STONE (66). The HONEY-COMB-
 STONE (67). SPAR (68), shot or crystal-
 D lized.

(59) Selenites.

(60) Lapis Specularis
 Plinii.

(61) Belemnites, Da-
 ctyleus Idæus, Lapis Lyn-
 cis Offic. which probably
 was the *Lyncurius* of the
Antients.

(62) Coralloidea Fof-
 filia.

(63) Stelechites.

(64) Mycetites.

(65) Porpites Plotii.

(66) Astroites recenti-
 orum.

(67) Lapis Favagino-
 fus.

(68) *What we call Spar,*
 Laz. Erkeren, and the
other Mineralists that have

*wrote in the German Lan-
 guage, call Fluß. Agricola,
 and those who have
 wrote in Latin, Fluor.
 This is a mixed Body, con-
 sisting of Crystal incorpo-
 rated sometimes with Lac
 Lunæ, and sometimes with
 other mineral, stony, earthy,
 or metallick Matter. Where
 the crystalline Matter pre-
 vails, and is superior in
 Quantity, the Body is more
 or less pellucid: and shoots
 into regular angulated Fi-
 gures. But, where the
 other Matter prevails, its
 Figure is uncertain and
 irregular.*

18 *A Method of Fossils.*

lized. CAUK (69). CROYL-STONE (70).
The STONY-ICEYCLE (71). STONY-
COMFETS, OR DROP-STONES (72).
OSTEOCOLLA (73).

MEMBR. 2. Such Stones as are
found in lesser Masses, and do exceed
Marble in Hardness.

ARTIC. 1. That are Opake.

SECT.

(69) Kaulgum Cauk. *The Term used by the Miners in the Peake, to denote a coarse talky Spar. The Germans call Talk Kaalg.*

(70) Craulgum. Crystalliz'd Cauk; likewise from the Peak Lead Mines. *In this the Crystals are very small.*

(71) *The Stalactites of Authors. This is only Spar in the Shape of an Icecycle, accidentally formed in the perpendicular Fissures of the Stone out of the sparry, and other Matter that is drained out of the Strata*

by the Water passing thro' them into those Fissures.
V. Nat. Hist. Earth. Part iv. Confect. 7.

(72) Stalagmites. *The Stalagmites is Spar also, formed by the same Means into the Shape of Drops. The Italians call them Confetti di Tivoli.*

(73) Osteocolla, Spar likewise, generally coarse, concreted with earthy or stony Matter, precipitated by Water, and incrusted upon Sticks, Stones, and other like Bodies. Vid. Nat. Hist. Earth. Part iv. Sect. 13.

SECT. 1. Those which are, chiefly of one Colour. The NEPHRITIC-STONE (74). The MALACHITE (75). The ROOT of the EMERALD (76). The DIASPRO ROSSI (77), of the *Italian Antiquaries*.

SECT. 2. Those which are of several Colours. L'AZURE, OR ULTRA-
D 2 MARINE

(74) Lapis nephriticus. This is commonly of an uniform dusky Green; but some Samples I have seen of it, that are variegated with White, Black, and sometimes Yellow.

(75) This is the Molo-chites of Pliny. Molo-chites spissius virens, a Colore Malvæ nomine accepto, reddendis laudata Signis. Plin. xxxvii. 8. He takes notice, that the Antients commended it for Intaglias and Seals: And there are in my Collection several. 'Tis sometimes intirely green; but lighter than that of the

Stone foregoing, so as in Colour to resemble the Leaf of the Mallow, Μαράχην, or μολάχην, the Mallow, from which it has its Name; tho' sometimes it is veined with White, or spotted with Blue or Black.

(76) Περασίνος Dioscor. Prasius vilioris est Turbæ Plin. xxxvii. 8. Est æruginæ Coloris. Theophrast. Conf. de Laet. de Gem. & Lap. L. 1. c. 9. Gemmarii vocant Smaragdo prasum. & Matrem Smaragdi. De Laet. Ibid.

(77) Jaspis ruber, Ægyptius,

MARINE (78). The BLOOD-STONE (79).
The JASPER (80).

ARTIC. 2. That are semi-
pellucid.

SECT.

(78) Lapis Lazuli, seu
Cyaneus. *αβαρον*, Cærule-
um Dioscorid. *περὶ ἕλκω*
ισις. V. 106. The Ground
of this is blue, veined and
spotted with White, and a
glistening or metallic Yel-
low. It seems to be the
Sapphirus of Pliny, and
appears to be compos'd of,
1st, A white sparry or
crystalline Matter. 2dly,
Flakes of the golden or
yellow Talc, not different
from those in the Micæ.
3dly, A shining yellow
Substance, very like, and
indeed the same with the
finer Marcasite. This fumes
off in the Calcination of the
Stone, and casts a sulphu-
rous Smell. 4ly. A bright
blue Substance of great Use
amongst the Painters, pur-
chas'd by them, under the
Name of Ultramarine, at
a great Price: And when
rich, is found, upon Trial,
to yield about $\frac{1}{8}$ of Copper,
with a very little Silver.

(79) Heliotropium.
This is green, spotted with
a bright Blood-red. Tho'
there are some of this Sort
that are spotted with White;
others with Yellow. Some-
times there is Agate or Cry-
stall incorporated and uni-
ted in the Mass with this
Stone.

(80) Jaspis. The Basis
is usually of a greenish
Hue, and spotted with
Red, Yellow, White.
There are sometimes Parts
in this Stone that are in
some Degree pellucid, ap-
pearing not unlike the
Agate: Which was also ob-
serv'd by the Antient Na-
turalists. Viret & sæpe
translucet Jaspis. Plin.
xxxvii. 9. This the Itali-
an Antiquaries, Buona-
rotti, Medaglioni antichi.
Proem. p. 15. call Jaspis
Chalcedonia: And suppose
it to be the Jaspis Chalci-
dica Plinii.

SECT. 1. Those which have Colours, changeable according to the different Position of the Stone to the Light. The CATS-EYE (⁸¹). The OPAL (⁸²).

SECT. 2. Those which have the Colours fix'd and permanent. The harder and finer PEBBLES (⁸³), and FLINTS (⁸⁴). The AGATE (⁸⁵). The CAL-

(81) *Oculus Cati.* This is of a glistering Grey, interchanged with a Straw Colour: And answers the Description of the Asteria, given by Pliny. The Ancients assign'd that Name only with Regard to the Brightness and shining of the Stone; without any Consideration of Figure, which the Moderns seem only to have minded in their Asteria.

— Ἀστέριος, καλὸς, λίθος ὀϊα-
τίς Ἀστῆρ.

Μαρμαίρων — Dionys. Περιηγ.

(82) *Opalus.* In this there is an interchangeable Mixture of Red, Green, Yellow, and Blue. We have this Stone usually from Germany. It answers the Character of Pliny xxvii. 6. and doubt-

less is the same with the Opal of the Antients.

(83) *Calculi.* } Some of

(84) *Silices.* }

these are, thro' the whole Inside, of the same Colour, Black, Brown, Grey; White: others spotted, or lineated with various Colours. The Germans call our Flint Hornstein, tho' Flint is most commonly found in Form of Nodules: But 'tis sometimes found in thin Strata, when 'tis call'd Chert.

(85) *Achates.* Agats are only Varieties of the Flint Kind; they have a grey horny Ground, clouded, lineated, or spotted with different Colours, chiefly Dusky, Black, Brown, Red, and sometimes Blue.

CALCEDONY (86). The MOCHO-STONE (87). OCVLVS BELI (88). ONYX (89). SARDONYX (90). The COMMON

(86) Lapis Calcedonius. This is of the Agat-Kind; and of a misty Grey, clouded with Blue, or with Purple.

(87) Achates Mochoensis. Mocho-Stones. These are nearly related to the Agat-Kind, of a clear horny Grey, with Delineations representing Mosses, Shrubs and Branches, in Black, Brown, or Red, in the Substance of the Stone. Dendrachates, velut Arbuscula insignis. Plin. xxxvii. 10.

(88) The Oculus Beli of the modern Jewellers, and probably of Pliny, is only an accidental Variety of the Agat-Kind; having a grey horny Ground, with circular Delineations, and a Spot in the middle of them, somewhat resembling the Sight of the Eye; whence the Stone had its Name.

(89) The Onyx is likewise an accidental Variety of the Agat-Kind. 'Tis of a

dark horny Colour, in which is a Plate of a blueish White, and sometimes of Red; οὐχίον, μὲν ἰν λευκῶ ἢ γαίῳ παραμυλα. Theophr. Onyx mixta est ex albo & fusco parallelis. Laet. Italis Nicolo de Quibusdam, Achates bicolor. The said Colours lying parallel, their Surfaces terminating, and meeting in a Plane. The Lapidaries usually cut this Stone into two, thro' the middle of the blueish white Plate; so that Part of the White is left adhering to the darker Colour in each. When on one or both Sides the White, there happens to lie also a Plate of a reddish or Flesh-Colour, the Jewellers call the Stone a Sardonyx.

(90) Sardonyx. The Lapidaries usually cause this to be cut, so as to shew three Colours, Flesh, White and dark, lying in Planes, on one another. The Sardonyx is another Variety of the Agat-Kind.

MON-CARNELION (91). The WHITE-CARNELION (92). The YELLOW-CARNELION (93). The BERYLL (94).

ARTIC. 3. That are in some Degree pellucid and transparent.

N. B. The Stones which follow in this third Article, are those which the Lapidaries usually call Gemms. The natural Constitution of these having not been hitherto sufficiently explain'd, I presume it will not be thought amiss, that I premise something on this Subject; since 'tis from this only, that their proper Names can be ascertained, and

(91) *This has its Name from its Flesh-Colour; which is, in some of these Stones, paler, when 'tis call'd the female Carnelion; in others deeper, call'd the Male. 'Tis the Sardion Theophrasti, L. περι λιθων, Sarda Plinii. L. 37. c. 6. and the Carneolus of the Moderns. The Italians give it the Name of Cornalina.*

(93) *The yellow Carnelion is very rare.*

(92) *In the White of this, sometimes there is a very slight cast of Blue.*

(94) *The Beryll of our Lapidaries, is only a fine sort of Carnelion, of a more deep bright Red, sometimes with a cast of Yellow, and more transparent than the common Carnelion. The Beryllus of the Antients was a quite different Stone, of a Blueish-green Colour: and probably the same with our Aquamarine.*

and their true Ranks assign'd. The Basis, or prime constituent Matter of all of them is, when pure, wholly diaphanous, pellucid, and either Crystal, or an Adamantine Matter, that is more firm and hard. But we find frequently the Diaphaneity of this Matter changed and lessen'd, by Means of a fine metallic Matter, incorporated with the diaphanous, in the original Concretion and Formation of the Stones. By the Access and Mixture of this metallic Matter, I find, by various Experiments and Observations, which will appear in their proper Place, 1st. That the Weight, or specifick Gravity of the Stone, is somewhat increased. 2. The Hardness of the Stone is varied, chiefly in the Crystallin Kind. 3. The Figure into which the pellucid Matter naturally shoots, is changed, by Lead incorporated with that Matter, frequently into a Cubic Form; by Tin, into a quadrilateral Pyramid; by Copper, into very differing Figures uncertainly; by Iron, chiefly into Rhomboids. 4. A Tincture, or Colour, is impar-

imparted to the Stone, paler or deeper in Proportion to the Quantity of the additional Metal. 'Tis, in some, so little, as hardly sensibly to reflect the Light, or give any apparent Colour; when more, it gives a slight pale Colour; when more, still a deeper, and more a saturate: When so much as perfectly to obstruct all Passage of the Light, the Stone quite loses its Transparency or Diaphaneity, and becomes opake. Of this we have Instances in the Tin-Pyramids, the Iron-Rhombs, the Lead-Cubes, and when join'd by Copper, as in the Lap. Nephriticus, the Malachites, Lap. Lazuli, Heliotropium, Jasper, and in the yellow brassy Ludus Paracelsi; or by Iron, as in the dusky blackish Ludus Paracelsi. When the metallic Matter is not in so great Quantity, as to refuse and bar all Passage to the Light, but yet so great as to reflect it, and shew a Colour; this, where Lead is the Ingredient, is Yellow. Hence the Topaz, and the Jacinth, which probably, with the Lead, has an Admixture of Iron, to which

it owes the mix'd or flame Colour. When Tin is the Ingredient, the Stone is by it render'd black; as in the Tin-Grains, and the black Agat. Where Iron is the Ingredient, the Stone is by it render'd red. Hence the Carnelion, the Beryl, the Garnet, the Rubin, the Carbuncle, the Amethyst. Where the Ingredient is Copper, if attended with any Alkali that may happen to join it, the Stone is blue; hence the Sapphire, and the Water-Sapphire, if attended with an Acid, green; hence the Emerald. When the Ingredient is both Copper and Iron, the Stone is of a Colour mix'd with Blue and Green. Hence the Aquemarine; when Copper and Lead, of a Green and Yellow, as in the Cryfolit.

By the Bounds I am tied up to, I am so restrain'd, that I can only hint that, from what has been said, may be concluded easily enough, that there can be no fix'd and unerring Test or Standard, whereby the Kinds and Names of these Bodies may be constantly ascertain'd.

tain'd. For, if the metallic Matter that happen'd to attend the Gemmeous in its Formation, and to enter the Composition of the same Stone was various and uncertain, and the Quantity of it as various and uncertain, there must, in course, be some Variety and Uncertainty in the Colour, from which both the Name and Kind of the Stone is determin'd: And 'tis from this that arises the Difference and Confusion that we find among the Writers of Gemms, both Antient and Modern. When the same Kind of Stone has its Varieties and Differences, the Describers of it, tho' never so accurate, must needs vary and differ; tho' not so much as to leave no Rules or Characters whereby to distinguish and form a Judgment of most of these Bodies. For my own Part, amidst so much Darknes and Confusion, I hope I have not gone far out of the Way, or much mistaken my Aim: And what I shall offer by and by, relating to Metals, will give some further Light into this so dark and intricate an Affair. I

must not forget to take notice, that even the Placing and Distribution of the metallic Matter to the several Parts of the same Stone, is not ever uniform, but in one Part a Red, or Iron, shews it self, in another a Blue, or Copper; nay, in some Parts 'tis perfectly clear and transparent, without the least Appearance of Colour, or metallic Admixture. Of all which Phenomena, there are Instances in my Collection.

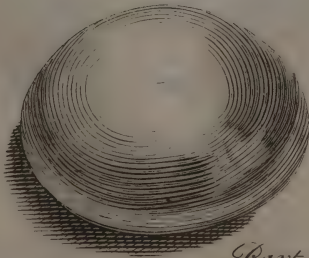
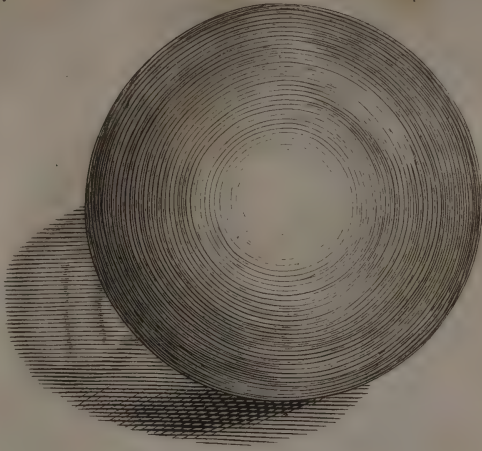
SECT. I. Those which are tinged with some Colour. The *TOPAZ* (91). The *HYACINTHUS* (92), or Jacinth of the Jewellers. The *GARNET* (93).
The

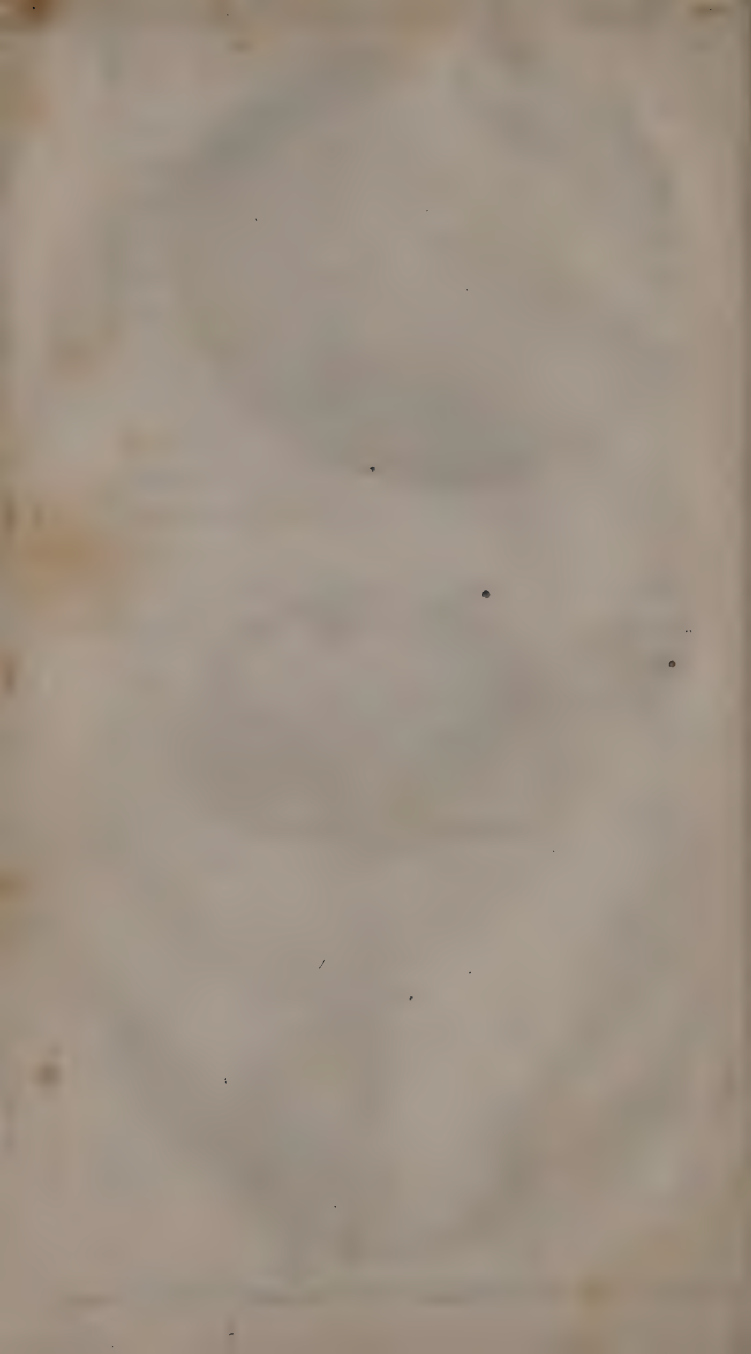
(91) *This is of a yellow or Gold Colour. 'Tis the Chrysolithus of the Antients.*

(92) *This is of a deep redish Yellow, approaching a Flame Colour, or the deepest Amber. The Jewellers have two Sorts, a paler and a deeper, which they call la Belle, and which probably may be a Species of the Carbuncle of the Antients. The Hy-*

acinthus of the Antients was certainly a much different Stone, in Colour Purple, tending to Blue, and somewhat resembling the Flower of the Hyacinth, or Violet. Conf. Plin. L. 37. c. 9. In Amethysto fulgor violaceus dilutus est in Hyacintho. Plin. xxxvii. 9.

(93) *Lapis Granatus. This seems to be a Species of the Carbuncle of the Antients,*





The ROCKY-RUBY (94). The BALASS-RUBY (95). The SPINELL-RUBY (96). The CARBUNCLE (97). The AMETHYST (98). The SAPPHIRE (99). The WATER-

Antients. The Bohemian is red, with a slight Cast of a Flame Colour. The Syrian is red, with a slight cast of Purple.

(94) Rubinus rupium. This is of a Red deep, and the hardest of all the Kinds.

(95) Rubinus Balassius. This is of a Crimson Colour, with a Cast of Purple, and seems, best of all the three, to answer the Description of the Ruby of the Antients.

(96) Rubinus Spinelius. This is of a bright rosy Red; 'tis softer than either of the foregoing. Some late Writers suppose the Rubies to be described by the Antients, among their Carbunculi.

(97) The Carbuncle of the modern Jewellers is a Stone of the Ruby-Kind, very rare, and of a rich Blood-red Colour. Of the *Αρδαζ*, or Carbuncle of the Antients. See Theophrast.

& Plin. L. 37. c. 7.

(98) Amethystus. This is of a bright Purple. *Ἀμεθυστον διονοπων τηχερόα.* Theophr. Uvas maturas Colore refert. Laet. Plin. ad vini Colorem accedit in violam desinens.

(99) Sapphirus. The Sapphire is of a bright blue Colour. We have this Stone from the East Indies, where it is call'd Nilaa from its Colour; Nil, or Anil, being the Word they use for Indigo, and probably may denote blue in general. It does not appear that this Stone was known to the Antients. At least there is no Account of it in any of their Books extant. 'Tis certain the Sapphirus of Pliny is much different from our Sapphire; and his Description answers to the Lapis Lazuli. In Sapphiris aurum Punctis collucet. Plin. Ita fere & Theophrast. & Isidor.

WATER-SAPPHIRE (100). The AQUA-MARINA (101), of the *Italian* Lapidaries. The EMERALD (102). The CHRYSOLITE (103).

SECT. 2. Those which are perfectly clear, diaphanous, and without any Colour at all. CRYSTAL (104). The WHITE-

(100) Sapphirus aquea. *This is the occidental Sapphire, and is neither of so bright a Blue, nor so hard as the Oriental.*

(101) *The Aque Marine is of a Sea or Blueish Green. This Stone seems to me to be the Beryllus of Pliny. That judicious learned Antiquary S. P. Buonazotti is of the same Opinion. Medaglioni Antichi. p. 113. & alibi passim. Pliny ranks it amongst the green translucent Gems, representing it as related to the Smaragdus, but of a Colour less brisk, and imitating a pure Sea-Water Green.*

(102) Smaragdus. *This is of a bright Grass-Green. 'Tis found in Fissures of Rocks along with Copper Ore.*

(103) *This is the Topazius of the Antients. Vid. Plin. 37. c. 8. 'Tis of a dusky Green, with a Cast of Yellow.*

(104) Crystallus. *This is certainly known and distinguish'd by the Degree of its Diaphaneity, and of its Refraction: as also of its Hardness, which are ever the same. 'Tis found both lodged in the Strata, and form'd in the Veins, or perpendicular Fissures of them. In these last, 'tis found ever in Form of an hexangular Column, adhering at one End to the Stone, on the Side of those Fissures, and near the other, lessening gradually, till it terminates in a Point. This is call'd by the Lapidaries Sprigg, or Rock Crystal: And of this Sort*

is the Iris of Pliny, Agricola, and Dr. Lister. *Philos. Trans.* No. 110. p. 222. that fine Crystal of the Alps, as also that of Bohemia, Hungary, and other Countries, as is likewise that found in the Tin-Loads or Veins in Cornwall; tho' a great deal of this is coloured, fouled, and rendred opake, by Admixture of metallic and mineral Matter with the Crystallin. Of this Kind of Crystal also, are the better and larger Bristol-Stones, the Kerry-Stones of Ireland, the Pseudadamantes of Authors, and particularly of A. Boetius de *Lap. & Gem.* p. 120. The Crystal in Form of Nodules, is found lodged sometimes in the stony, but chiefly in the earthy Strata, or among the Gravel, or other loose Rubble left in a Train, by the Water departing at the Conclusion of the Deluge. This Sort, call'd by the Lapidaries, Pebble-Crystal, is in Shape irregular, and in Form of the common Nodules, Pebbles and Flints. But there is also frequently found Crystal lodg'd in the Strata, in a Form regular, ever

hexangular, which is its distinguishing and characteristic Form, and approaching that found in the Fissures; of this Rank are, 1. Crystallus in acumen utrinque desinens, Crystal pointed at both the opposite Ends. Of this I have observ'd two Sorts; the one consists of two hexagonal Pyramids, applied Basis to Basis.

Aldrovandus has an Icon of this Sort, which he calls an Iris in his *Musæum.* p. 941. Boetius has another in his *Hist. Lap. & Gem.* p. 218. The other consists of two like Pyramids, but having an hexagonal Column intervening. Boetius has there likewise an Icon of this Sort, as has also Aldrovandus p. 989. No. 2, where he gives it the Name of Crystallum parvum utrinq; æqualiter mucronatum. He takes it from Gesner, *De Fig. Lapid.* p. 19. who was under some Doubt, whether there had not been something of Art used in the forming of it; but that proceeded from his not having made sufficient Enquiry into these, and other not less elegant natural Producti-

32 *A Method of Fossils.*

WHITE-SAPPHIRE (105). The DIAMOND (106).

N. B.

ons found commonly in the Earth. Nor can I quit the Subject, without taking notice, that I have observed of both these Sorts, not only single and separate, but joined and united in Clusters, several in the same Mass, of which, as well as of those found single, there are various Samples in my Cabinets. 2. Crystallus Forma globosa solida Pyramidibus pellucidis per totam suam superficiem exteriorem surrectis obfita, the Echinated Crystallin Ball. I have rarely observed any of these Balls, that have exceeded two inches in diameter. 3. Crystallus globosa externè rudis & scabra, intus cava, Cavitatem totam habens Pyramidibus Crystallinis obfitam, the concave Crystallin Ball. I have observed of these Crystal Pyramids, tho' commonly transparent and diaphanous, some that have been tinged Yellow, others red, others purple. The exterior Surface of the

Crusts and Shells of these Balls are commonly of a brown rust Colour, consisting chiefly of a coarse Spar, with some little earthy, stony, Mineral, or metallick Matter incorporated with it. I have observ'd these Balls of all sizes, from the Bigness of a Walnut, to that of the largest Melon. They are seldom exactly round, but of a Figure nearly approaching it, tho' somewhat compress'd. The three foregoing Kinds are found in most Countries; but I have observ'd them in greatest Plenty about Bristol, chiefly in the Neighbourhood of Kings-Weston in Gloucestershire.

(105) Sapphirus alba. The white Crystalline Sapphire, is so called because 'tis of full as great specific Hardness as the Blue, but colourless, and clear as Crystal.

(106) Adamas. The Diamond. This Stone is preferable, and vastly superior to all others in Lustre and

N. B. *The Characteristic of the Stones of this Section, I mean, their being perfectly clear, diaphanous, and without any Colour at all, does not hold so universally, but that there are Deviations from it: And they are found sometimes tinged and coloured. Thus there is Crystal, having nearly the same Degree of Hardness with the common, that is notwithstanding of a yellow Hue; as likewise of a Red, of a Blue, or of a Green. To these the Writers of Gemms have given the Names of Pseudo-Topasius, Pseudo-Beryllus, Pseudo-Sapphirus, and Pseudo-Smaragdus; Conf. A. Boet. de Lap. & Gem. L. 2. c. 72. p. 219. Sometimes Part of the Stone is clear, and Part tinged, not only with one simple Colour, but perhaps with two, or more, all different. In the same Manner, the oriental Sapphire, Topaz, Amethyst, Emerald, and Ruby, are all of the same Hardness.*

F

There

and Beauty: As also in Hardness, which renders it more durable and lasting, and therefore much more valuable than any other Stone. Such it has been reputed in all Ages, and by all Nations: And indeed the very Top-Jewel of the whole Creation.

There are Diamonds tinged with Yellow: Others with Red, Blue, or Green, tho' these last be very rare. The Tinctures and Colours of these, as of all other Gemms, and Stones, are owing to the Principles assign'd above; I mean metallic and mineral Matter, incorporated with the diaphanous, at the first Formation of the Body. That they actually are so, and the Thing really Fact, I have given several Instances in the Catalogues and Accounts of the Fossils, both of my English, and Foreign Collections; as also various Proofs from Trials in the Fire, and Illustrations by Chymical Experiments in my Art of Essaying, and some other Papers.

Class 3. SALTS.

OR Bodies friable and brittle, in some degree pellucid, sharp, or pungent to the Taste, dissoluble in Water, but, after that is evaporated, incorporating again, crystallizing, and forming themselves into angular Figures.

The

The FOSSIL-SALT (1). SAL-AMMONIAC (2). The TINCAL (3) of the Persians.

F 2

(1) Fossil, or Rock-Salt, and Sal Gemmeum; so call'd from its breaking frequently into Gemm-like Squares. These two Salts differ not in Nature or Property from each other: Nor indeed from the Common-Salt, of the Salt Springs, or from that of the Sea, when all are equally pure and free from extraneous Matter.

(2) Sal Cyrenaicum seu Ammoniacum nativum veterum. Plin. L. 37. c. 7. & Dioscorid. L. 5. c. 126. according to Fr. Imperati, De Fossil. p. 20. 'Tis found still in Ammonia, the Country mention'd by the Antients, and from which it had its Name. His Account is confirm'd by Mr. Jezreel Jones, who, having liv'd sometime in the Kingdom of Morocco, and made himself Master of the Language, was, at

the Expence of Dr. Tenison, late Lord Arch-Bishop of Canterbury, my Lord Somers, Sir Hans Sloane, my self, and some others, Lovers of natural History, sent, about the Year 1705, into the Country thereabouts, to make Observations and Collections: And he found this Salt, native, in the Earth, in several Places. This, as likewise Tincal and Natron, are not simple Bodies; but different Salts concreted with a small Admixture of some terrestrial Substance.

(3) The Tincal of the Persians. This seems to be the Cryfocolla of the Antients; and is what our Borax is, made of. The Indians of Bengal, where there are great Quantities of it brought dwn the Ganges, call it Swagar.

sians. NATRON (4). The NITRE (5) of the Moderns, or Petre-Salt. The FOSSIL-

(4) *This is the Nitron, Nitrum of the Egyptians, and had its Name from Nitria a Province of that Country in which chiefly 'twas found; but 'tis call'd there at present Natron, or Latron. Dr. Hunting-*
 ton, *Epist. p. 68. " Latron Aquis in Nitria*
" Ægypti deserto, — Super-
" natat ad modum Glaci-
" ciei, cui maxime simile
" est, sed durius, rubef-
" cens. Carnem insulsam
" gratam reddit. p. 69.
" — Desertum, quod o-
" lim Nitriæ, hodie S.
" Macarii dicitur, Locus
" est sterilissimus—. A-
" qua salsa est. Arbores
" nullæ sunt, neque Ar-
" busta, nullæque præter
" Alkali, Herbæ. Conf.
" Disc. of Vegetation.
" Philos. Trans. June.
" 1699. Tenet equidem
" Salis lacum æque ac
" Nitri, nec non Lapi-
" dum, Calcis, & Margæ
" Fodinas. There have
been made several Experi-
ments upon Natron, by the

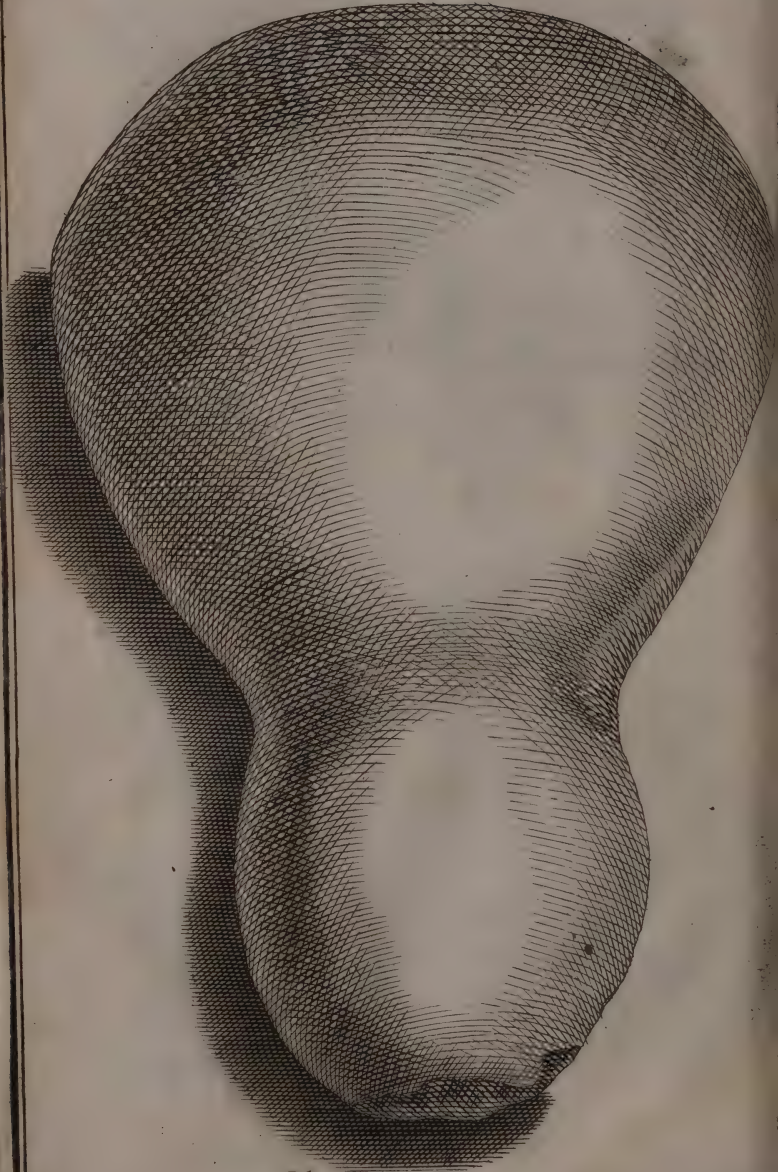
Operator of the Acad. des
Sciences, of which there
is an Account in Dr.
Tournfort's Preface to his
Hist. des Plantes aux En-
vironns de Paris. p. 11.
Conf. 37.

(5) Nitre, *while in its*
native State, is call'd Pe-
tre-Salt; when refin'd,
Salt-Petre. 'Tis of Use in
Vegetation. Vid. Disc. of
Vegetation. Ib. and that
it might be every where
ready, and at hand, to
serve that important End,
'tis scattered about, and
mix'd with the Earth, near
the Surface, on which Ve-
getables are produced in all
Countries quite round the
Globe. But 'tis found like-
wise lying very shallow, and
but just underneath the
Turf, in much the greatest
Quantity that we know of,
about Patnass, in the nor-
thern Parts of the Kingdom
of Bengal; whence we have
ours. Father Fœlix White,
was, on Account of his
Mission, some Time in the
Country where this Salt is

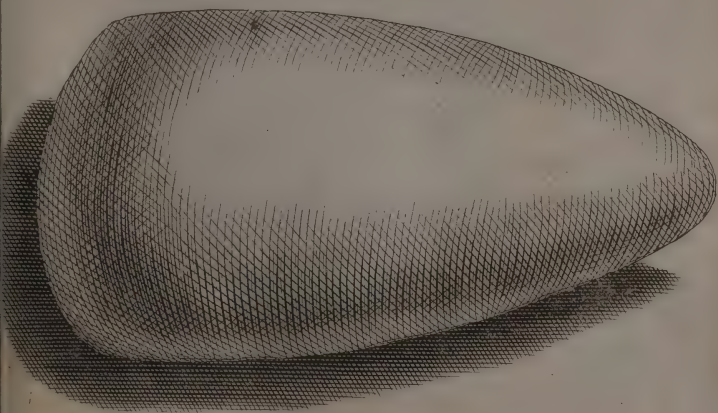
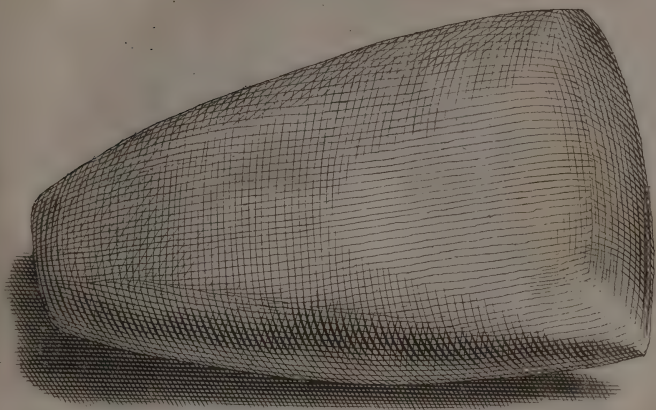


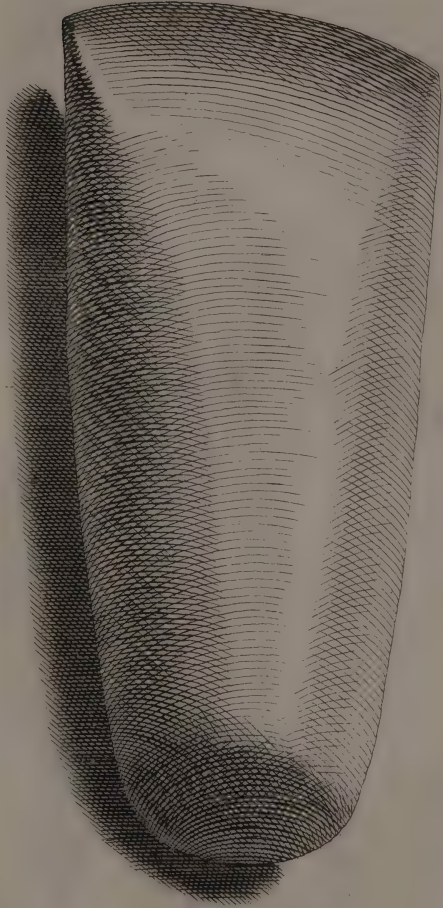
Fig. 2.

P. 37.



Part 2.







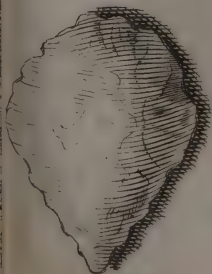
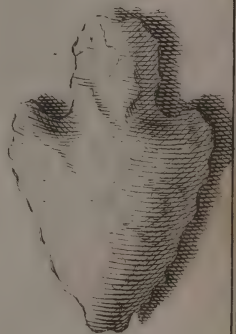
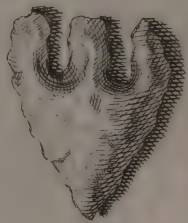
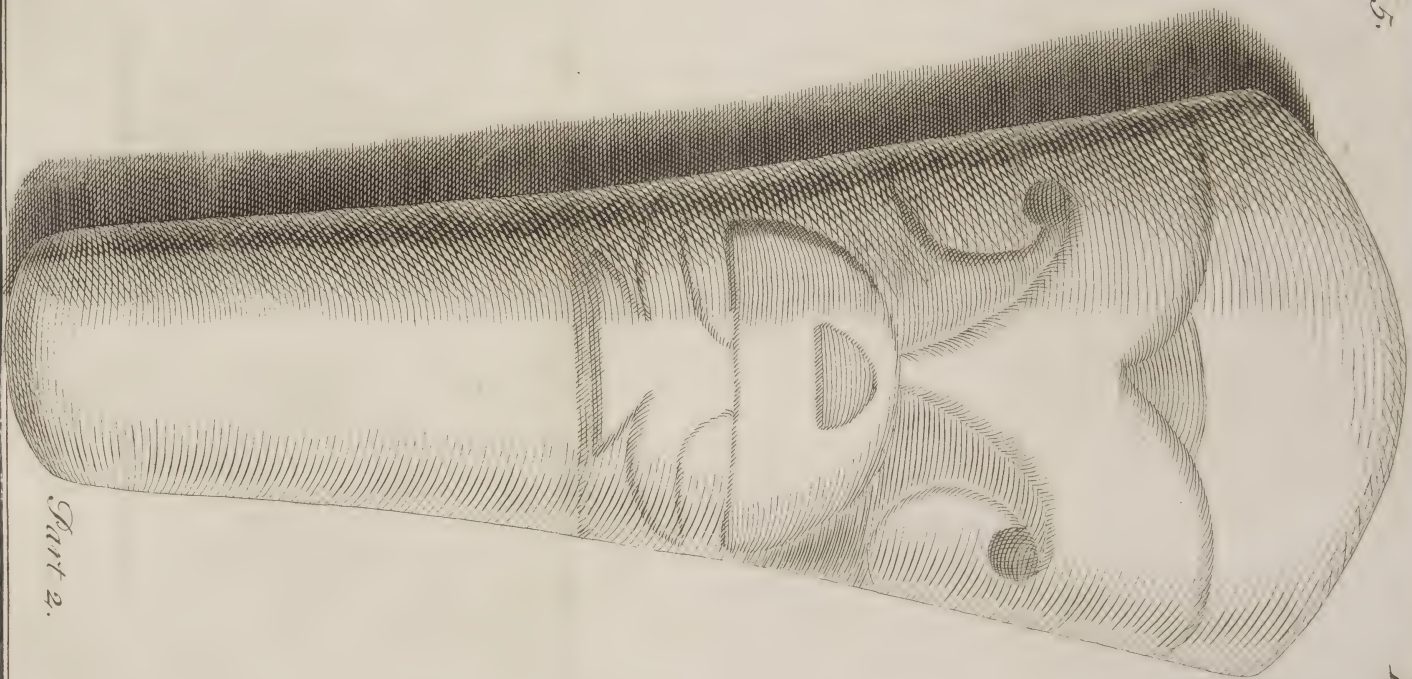
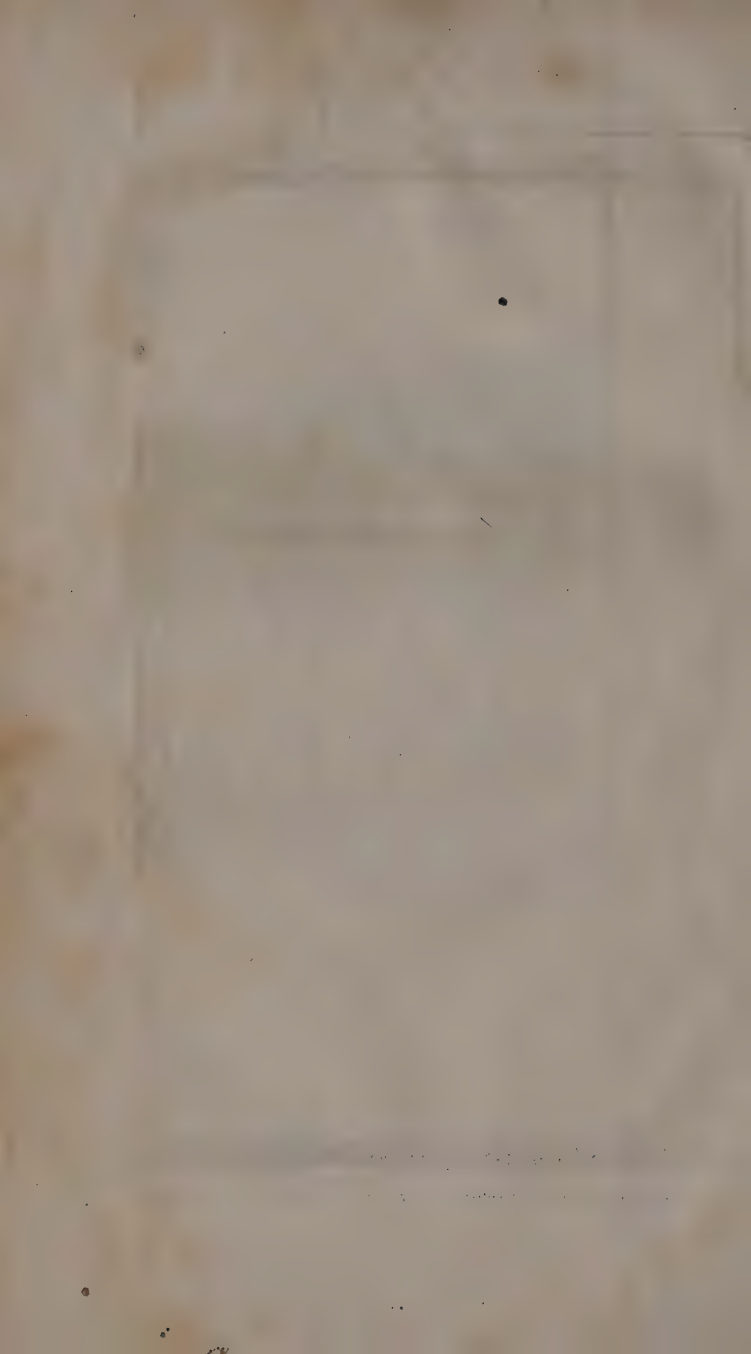


Fig. 5.



P. 37.

Part 2.



FOSSIL-ACID-SALT (6), seldom found simple and pure, but in Form of SULPHUR, ALUM, or VITRIOL.

Class 4. BITUMENS.

OR Bodies that readily take Fire, and yield an Oyl; and that are soluble in Water.

CA-

got; and he favour'd me with a Relation of the incredible great Plenty of it there, the Manner in which it lies, and all Circumstances of it; but that Relation is too long to be inserted here.

(6) Sal Acidum Fossile. This is indeed the Basis of Sulphur, Alum, and Vitriol. The simple Salt, extracted out of any of the three indifferently, is the same; and is capable of constituting either of the

other; with the Addition of a small Proportion of a bituminous, cretaceous, or metallic Matter. Sulphur is produced by incorporating an oily or bituminous Matter with this Salt. Alum is produced, by joining a cretaceous or other like earthy Matter with it. Vitriol, by Addition of a metallic Matter. If Iron be made use of, the Vitriol will be green; if Copper, Blue.

CAPUT I. Those that are liquid.
NAPHTHA (1). *PETROLEUM* (2). *BARBADOES-TARR* (3).

CA-

(1) *Naphtha*, *νάφθα*, *Dioscor. L. 1. c. 101.* *Strabo, Geogr. L. 16.* represents it as a *Liquation of Bitumen.* It swims on the Top of the Water of Wells and Springs. *Salmas. Exerc. in Solin.* That found about *Babylon* is in some Springs whitish, tho' it be generally black, *Strabo, Ib.* and differs little from *Petroleum.*

(2) *Petroleum* is a liquid *Bitumen*, *Plin. xxxv. 15.* black, floating on the Water of Springs. Such is that of a Spring rising at the Foot of a Mountain

near the Sea, in the Island *Zant*, mention'd by the *Antients.* *Sir Geo. Wheeler* has also given an Account of it in his *Voyages*, p. 48.

(3) *Oleum Terræ Barbadoense.* See *Ligon's Hist.* of *Barbadoes.* It differs little from the *Petroleum*, found floating on a small Spring at *Pichford* in *Shropshire*, *Camden.* and in other Springs of *England*, and of *Scotland.* *Sir Robert Sibald Prodr. Nat. Hist. Scotiæ. Part 2. L. 4. c. 4.*

CAPUT 2. Those that are call'd BITUMEN (4). PISSASPHALTON (5). AMBER (6). IEAT (7). CANNEL-COAL (8), PIT-COAL (9), *Stone-Coal, Quarry-Coal, Sea-Coal.*

Class

(4) Bitumen. Ἄσφαλτος. Dioscorides L. 2. c. 99. mentions it as found about Sidon in Phœnicia, in Zant and Sicily, but prefers that of Judæa to all others. Dioscor. Strabo, and others of the Antients, assert, that both Bitumen and Petroleum are found plentifully about Babylon; which very remarkably confirms the Mosaic Account of the Use of it as Mortar, in building the Tower of Babel, Gen. xi. 3. Nay, the Buildings of old Babylon were, like that Tower, of Brick cemented with Bitumen. Strabo, L. 16. Plin. L. 35. c. 15.

(5) Πισάσφαλτος was found in the Ceraunian Mountains of Apollonia, Dioscor. L. 1. c. 100. The an-

cient Greeks gave the Name of Πισάσφαλτος to the liquid, as well as to the solid Bitumen.

(6) Succinum Lyncurion Demonstratus ap. Plin. L. 372. Græcis, ἡλεκτρον: Germanis Veteribus, Glesum. Tacit. de Morib. Germ. c. 45. Arabibus, Karabe.

(7) Gagates. Γάγαλιος. Dioscor. v. 146. Gagates Lap. niger est, planus, pumicosus, non multum a Ligno differens, levis, fragilis. Plin. L. 36. 19.

(8) This seems to be the Lapis Ampelites of the Antients. Bitumini simillima est Ampelites. Plin. xxxv. 16. Ἀμπελίτις Dioscor. L. 5. c. 181.

(9) Carbo fossilis Carbo saxeus. λιθαίθηραξ.

Class 5. MINERALS.

OR Bodies nearly related to Metals ; as having some Properties in common with them, being particularly ponderous, and splendent with a metallic Brightness.

CAPUT I. Those that are fluid:
NATIVE-MERCURY, OR VIRGIN-QUICK-SILVER (1).

CA-

(1) Dioscorides takes notice of Quick-Silver that was native, and found in the Earth fluid, free, and without Mixture : and calls it *ὑδράργυρος καὶ ἰανθόν*, Mercury is a Mineral of very singular and peculiar Nature, and differs from all others in keeping constantly a fluid Form, when pure, separate, and unmix'd. Nor can it ever be fix'd, or brought to Consistence and Solidity, by any Art whatever. It amalgams with all Metals, except only Iron, and is susceptible of a more consistent Form, when united with Nitre, Alum, or o-

ther acid Salts, and with Arsenic, or Sulphur. But, when disengaged from them, and separated again, it ever appears in its original natural Condition, and fluid as before. Would our Alchymists, who work much on Mercury, reflect rightly on this, 'twould put an End to their troublesome, expensive, and delusive Amusements. 'Tis call'd *Χυθόν ἄργυρον* by Theophrast. de Lap. *ὑδράργυρος* by Dioscor. L. 5. c. 10. Hydrargyrum by Pliny, L. 33 c. 8. Argentum Vivum, *ibid.* L. 33; c. 6.

CAPUT. 2. Those that are solid, and will melt in the Fire, but are not ductil or malleable. NATIVE-CINNABAR (2). NATIVE-YELLOW-ARSENICK (3). NATIVE-RED-ARSENICK (4).

G The

(2) Cinnabar is the Ore out of which Quick-Silver is drawn, and consists partly of a mercurial, and partly of a sulphureo-ochreous Matter. Dioscorides, L. 5, c. 109, 110. calls it Ἀμμοῦν, or as other Copies have it, Μίλιον, and makes a Distinction betwixt this, and Cinnabar, Κιννάβαρι. The former, he says, they had from Spain, the latter from Africa; and probably there might be some Difference betwixt them; but, by the Properties and Uses he ascribes to each, they seem to be of the same Kind. At least Pliny tells us expressly some of the Greek Writers called that Cinnabari, which the Romans called Minium, and out of which they extracted their Hydrargyrum. Others called it Milton; "Milton

" quidam Cinnabari L. 37. c. 7. conf. c. 8. I. Ant. Saracenus Not. in Dioscorid. corrects the Place, and substitutes Ammion; but without Reason, Μίλιος being the Word used by some of the Greek Writers, and particularly by Strabo, constantly. Theophr. L. de Lap. uses only the Word Κιννάβαρι; so that 'tis plain, that ours and the Antient Cinnabar is the same

(3) Arsenicum Aureum nativum. Ἀρσενικόν Dioscorid. L. 5. c. 121. Auripigmentum, Plin. L. 35. c. 6. & L. 33. c. 4. Arsenicum, L. 34. c. 18.

(4) Arsenicum rubrum nativum, Σανδαράχη Dioscorid. L. 5. c. 122. Sandaracha. Plin. L. 34. c. 18. This is mention'd by Agricola de Nat. Fossil. L. 3. Fr. Imperati. de Foss. p. 29. Ol. Worm. Mus.

L. 1.

The PYRITES (5). The MARCASITE (6).
COBALT

L. I. Sect. I. c. 12. and others. The Hungarian Sandaracha is of an Orange Colour: But that from East India of a deeper Red. I have Samples of each; but both are very rare.

(5) Pyrites. This Body ever contains more or less of the Sal acidum, that is incorporated with an oleose or bituminous Matter, and so constitutes a Sulphur. This renders it so apt to give Fire, from which it has its Name Πυρίτις. πύρ. Fire. It sometimes contains a cretaceous, or ochreous, and constantly a metallic Matter, in it: In proportion, as any of these prevail in Quantity, and come forth incorporated with the Salt, it appears in form of Sulphur, Alum, or Vitriol. Conf. Not. ad Class. 3. supra. I never met with any Pyritæ that held Lead or Tin. Copper there is in some of them; and Iron in all: but the Quantity of it is not considerable. In those that hold most of

it, when the Salt is drawn off, the Iron usually constitutes about $\frac{1}{8}$ of what remains. They all hold an extremely small and inconsiderable Quantity of Gold, and some few of Silver.

(6) Marcasita. The Writers of Minerals generally give the Name Pyrites and Marcasita, indifferently, to the same sort of Body: And indeed they both agree in some Things. But I choose rather to restrain the Name of Pyrites wholly to the Nodules, or those that are found lodged in Strata, that are separate, and not a Part of, or depending on the common Matter of the Stratum. The Marcasite, on the contrary, is Part of the Matter that either constitutes the Stratum, or is lodged in the perpendicular Fissures of the Strata. The Marcasite frequently holds Arsenic; which the Pyrites does rarely, if ever. There is Sulphur in all Marcasites: And Antimony and Bismuth in some. The Metalls they yield

COBALT (7). CALAMIN (8). ANTIMONY (9). TIN-GLASS (10). ZINK (11). WAD, OR BLACK-LEAD (12).

Class 6. METALLS.

OR Bodies that are ponderous, splendid, solid, will melt in the Fire, and are ductil or malleable.

G 2

I. GOLD.

yield are chiefly Copper, Iron, and Tin. When any of those Metalls were in considerable Quantity, these Bodies lose the Name of Marcasites, and are call'd Ores. In Cornwall, and the West, they call them Mundick, in which there is commonly Copper, or Tin, and sometimes Iron. But Mundick abounds so much in Sulphur, that the Metalls are very difficult to be parted. Being run down all together, they compose a Kind of Bell-Metall, used by some for making Bells, Mortars, and the like.

(7) Cobaltum, a Marcasite frequent in Saxony.

It is plentifully impregnated with Arsenic, contains Copper, and some Silver. G. Agricola, In Bermano p. 690. 701. Ol. Wormius, Musæum. p. 128. and the rest of the Writers of Minerals take this for the Cadmia of the Antients. Being sublim'd, the Flores are of a blue Colour. This the German Mineralists call Zaffir.

(8) Lapis Calammaris.

(9) Antimonium S. Stibium.

(10) Bismathum.

(11) Speltrum.

(12) Nigrica fabrilis, Merreti. Pinax Rer. Nat. Britan.

44 *A Method of Fossils.*

1. GOLD. 2. SILVER. 3. COPPER.
4. IRON. 5. TIN. 6. LEAD.

FROM what I have deliver'd on another Occasion † concerning the Confusion that Things lye in under Ground, and the various Combinations of Metalls amongst themselves, and their Mixture with almost all other Sorts of terrestrial Matter whatever, may readily be concluded how difficult a Task it is to describe the Ores of them, and distinguish each from other. I have for some Years been carefully examining those found in *England*, and procured Samples from most other Parts of the known World. What Rules and Distinctions of the various Sorts I have been able to make, I shall next deliver as clearly as the Bounds I am tied to will permit.

I. GOLD, *Aurum*, χρυσός. This Metall consists of Parts so infinitely subtil and fine, that when 'twas all in solution, and

† *Nat. Hist. Earth. Pt. 4.*

those

those Parts divided, and absolutely separated each from other, which was the Case at the Deluge, they would be so easily agitated and dispersed about every where, that 'tis not strange that we find more or less of this Metall incorporated with almost all Kinds of terrestrial Bodies whatever. But, as it seems, the main Bulk of it, before the Dissolution at the Deluge, lay chiefly in some particular Places, it subsided again in them; and there chiefly it must of course be at this Day found. 'Tis interspers'd, mix'd, and incorporated with the *Strata* of the Earth or stony Matter; and the Particles of it commonly so small, as not to be discernible; but sometimes they lye so close and thick, as well to compensate the Labour and Expence of washing away the Earth wherein they were lodged; and the stony Matter, after 'tis beat, broken, and finely reduc'd: For when this is separated by Means of Water, and decanted off, the Gold, being ponderous, all readily subsides to the Bottom; by which Means 'tis collected and preserv'd. In this Manner 'tis wrought in the Mines of *Cânia*,
and

and other Parts of *America*; in *Achin*, and other Parts of *India*, and the East; and in the Mid-land Parts of *Africa*. Gold is found likewise in the *Strata* in bigger Particles, Masses, and Lumps of various Sizes. The largest that I have seen of Gold thus separate and pure, taken out of a *Stratum*, weigh'd near three Ounces. But such are very seldom met with; though there are Accounts of Princes, and great Persons, living in the Countries where the Gold is got, that have much larger Lumps and Nodules of it. Besides, the Gold thus found in the *Strata*, 'tis likewise met with in the Veins and perpendicular *Fissures* of them, either incorporated with the Sparry, Mineral, or metallic Matter repositied there, or separate and pure. This last is ordinarily found adhering to the *Spar*, and run into Form of *Threads* and *Grains*; whence it has obtain'd the Name of *Aurum nativum fibrosum*, & *granulatum*. Sometimes such is found concreted and affix'd to the Stones on the Sides of the *Fissures*. Of all these there are Samples in my Collection.

THEN

THEN there is found Gold in Form of Dust, Powder, Grains, and Lumps, at, or near the Surface of the Earth; but chiefly on the Shores and Strands of the Rivers, and on the Sides, and at the Feet of Mountains. This is all wash'd forth of the Earth by the natural Action of Water; that found about Rivers, partly by their common flowing and wearing of the Banks, and partly by their more forcible Action, when there are great Tides, and Inundations; the Water washing away the lighter terrestrial Matter, and so bareing, uncovering, separating, and leaving behind the more heavy Metallic. In this Manner Gold has been found in all Ages; not only in the Countries where it abounds, and there are Mines of it, but in *Greece, Spain, Hungary*, and other Parts where there are none. That found about Mountains is washed forth by the Falls of Rains. These in some Countries are very great, powerful, and fall constantly at certain Seasons. They wash away the earthy, and even the looser stony Matter; by

by which Means they disclose the Gold: And where it happens to be repositied in any considerable Quantity within, after the Rains are over, 'tis found left on the sides of the Mountains, and about the Bottoms of them, in Plenty proportionate to the Greatness and Duration of the Rains. This is the Case of the Gold of *Quito* in *Peru*, and of most of that we receive from *Guinea*, and other Parts of *Africa*, where the Mountains, chiefly those up in the Country, abound with this Metall. Upon Trials in the Fire, I have found some of this *African* Gold so rich and pure, as to yield 97 or 98 *per Cent*.

2. SILVER. *Argentum*, ^{ἄργυρος}. This Metall is found in the Veins and Fissures of the *Strata*, sometimes native and pure, adhering either to the Stone on the Sides, or to the sparry, or other mineral Matter in the Veins, in various Forms, e. gr. of *Hairs* or *Threads*, finer or thicker, of branch'd *Shrubs*, and of *Feathers*; as also sometimes of *Grumuli*, *Masses* and *Lumps*; from which Forms it has obtain'd

obtain'd the Names of *Argentum Capillare, Fibrosum, Arborefcens, Plumofum, Grumulatum, Concretum.* The fineft Silver Ore of *Saxony*, is incorporated with *Sulphur* and *Arsenick*, which together impart to it a ruddy Hue. This Sort the Miners there call *Rothgultig-Ertz.* But in *Germany, Hungary, England,* and other Parts of *Europe*, the Silver is feparated from the Ore of *Lead*, chiefly, that fhining, fparkling Sort, that the Miners call *Steel-grain'd Ore.* I have, upon Trial, extracted from fome of this, one 15th Part of Silver; but fo great a Proportion is not common.

3. *Copper, Æs, κὺπριον, * Cuprum, κάλλχος.* The principal Varieties, and Sorts of the Ores of this Metall, are the *Pale-grey, the Black, the Red, the Glossy-Purple, the Blue, the Æruginous or Green:* The better Sort of *Mundick,* or the *Marcafitic Yellow,* fhining, Brafs-like Copper-Ore; the *fibrous,* or ftriated, and the *fparkling or Steel-grain'd.* Besides,

H

fides,

**Quoniam in Infulâ Cypro copiofè prognatum. Vide Plin.*

sides, this Ore is sometimes found native and pure, in Form of *Threads*; of *Shrubs* in *Flakes* and *Plates*, some solid and continuous, others porous; in *Grains*, *Masses*, and *Lumps*. These pass all in general, by the Name of *Virgin-Copper-Ore*: And many of them are so pure, as to be flexible and malleable, like the refin'd Metall it self. *Terre-verte*, *Terre-bleue* and *Ultramarine*, which is the blue Part of the *Lapis Lazuli*, all contain some Copper in them. The *Lapis Armenius*, † is really a Copper Ore, but generally very poor; tho' there is, in my Collection, some so rich, that it yields one third Copper.

4. *Iron, Ferrum, Σίδηρος*. I have observed above, that *Gold* is found intermingled with the sandy, earthy, or other common Matter of the *Strata*. I should have taken notice above, that *Copper* is found so too; and renders the Stone wherein it is contain'd, of a Green or a Blue, or a ruddy coppery Hue. Iron is frequently found

† Dioscorid. *περί ελης ίαση*. L. v. c. 105.

found in the same Manner in the *Strata*; and, when in Quantity, imparts a ruddy or ferruginous Colour to them: But neither Silver, Tin, nor Lead, are ever found in any considerable Quantity in the *Strata*. The harder red ochreous Iron-Ores, pass by the Name of *Rudle*; the softer by the Name of *Smitt*. There is more or less of this Metall likewise incorporated with the ferruginous crustated Bodies, the ochreous *Rust-coloured-Eagle-Stone*, the *Bezoar Mineral*, the ferruginous *Geodes*, and the *Enhydros*. There is found Iron-Ore, in Form of *Ludus Helmontii*, particularly in *Monmouthshire*, where this Sort is call'd *Pin-Ore*. The rest of the Sorts are, The *smooth-grain'd Iron-Ore*, which strikes Fire, and breaks much like a Flint, but is of a ruddy Colour: The *Hæmatites*, or *Schistos*, † which is of a striated, or fibrous Texture, and the *Iron Stalactitæ*; several of these naturally united into one Sheaf, pass by the Name of *Brush-Ore*. The *Rhomboid-Iron-Grains*. I have seen,

H 2 in

† Dioscorid. L. c.

in the Mines of the Forrest of *Dean* some little Iron Ore, in the Veins, shut into a *Ramose*, or *arborescent Form*. Iron is seldom found native and pure: I never saw but one small sample of it, which came from *Saxony*. But some of the richest Ores of this Metal, both the *English*, and those from *Germany*, being reduc'd to a very fine Powder, the purer Iron Grains follow and obey the Loadstone. *Magnes* the *Loadstone* also holds a little Iron, and is sometimes found in the Veins, along with the Ores of that Metall; as is also the *Magnesia*, or *Manganese*: And indeed this differs little from the *Hematites*, only that it is poorer, and yields less Iron. *Smiris*, or *Emery*, has likewise usually in it some small Admixture of *Iron*.

5. *Tin*, *Stannum*, *κασσίτερος*. There is of the Ore of this Metall got in lesser Quantities, in *Saxony*, and in *Bohemia*, and some on the Coasts of *Malabar* in the *East Indies*. But no Part of the World yields so much of it as *Cornwal*, nor so rich and good. This is the only Product
of

of the Nation, that was sent Abroad, before the *Romans* came hither. The *Britains* had, from the remotest Antiquity, carried on a Trade with the *Phœnicians* in this Commodity. They sent it in Boats, the best they had in those early barbarous Times, made of Wicker, and cover'd with Hides of Beasts, to the Isle of *Wight*, and thence, to the opposite Coasts of *France*, whence 'twas carried over Land to *Marseilles*; where the *Phœnicians* bought it, and transported it to all Places with which they had Commerce. The principal Sorts of *Tin-Ore* are the *Pale*, near *White*, the *Grey*, the *Brown*, the *Ruddy*; but the best and richest is the *Black*. I have never seen, nor heard of any *native pure Virgin Tin*. The *Tin Grains*, or *Tin Corns*, as the Miners call them, are the richest, and yield about half Metall. There are sometimes a very few Sparks of Metall in that sort of Stone that the Tinner's call *Pedancarn*, and in that which they call *Growan*. This last is a gritty Stone, of various Colours, and of *Talky* Constitution, having *Micæ* in it. The *Tin-Veins*, or as the

the

the Miners call them, *Loads*, are either in *Strata* of *Growan*, or of that grey, *Talky*, *Slaty* Stone, that the Tanners call *Killas*, *Raze*, or *Delvin*. The greatest Quantity of Tin-Ore is found in the *Loads*; but there is of the very same Sorts, found likewise in the *Shoads* or *Stream-Works*. These are Trains of Ore, Spar, and other Minerals, that were washed down from the *Loads*, by the Water departing at the End of the *Deluge*. Mr. *Carew*, in his *Survey of Cornwall*, has given some Account of those *Shoads*; but I have obtain'd a much fuller, more particular, and satisfying Account from some of the Gentlemen of that County, and Stewards of the Tin Mines, that have been curious, and taken Pains in making accurate Observations on the State of Things there.

6. *Lead*, *plumbum*, $\mu\acute{\omicron}\lambda\upsilon\beta\epsilon\sigma\omicron\varsigma$. The various Names and Distinctions of this Ore, used by the Workmen, are, the *Potters* or *Blue*, the *Grey*, the *greenish Yellow*, the *Talky*, the *Stony*, the *Cavernous*, the porous Sort, call'd on *Mendip*, *Honey-Comb*

Comb Lead-Ore, the *Star-grain'd Lead-Ore*, the *striated*, or *Antimoniated Lead-Ore*, the *sparkling* or *Steel-grain'd*; this commonly yields more or less Silver, and is what *Dioscorides*, and the Naturalists after him, call *Molybdæna*: *Pliny*, *Galena*. The *White* semi-diaphanous Lead-Ore, generally fibrous, but sometimes *flaky* or *plated*. The *Ericoid-Lead-Ore*, found concreted into the Form of the *Ramosæ Moss*, or, as some fancy, of *Heath* or *Erica*, whence it had its Name. The *Diced* or *Cubic Lead-Ore*. The *Saxon* Mineralists sometimes find Lead in the Veins, that is *native* and *pure*: But I never saw any except one Sample that was fetch'd for me, with several other Ores, from *Mendip*, by Mr. *John Hutchinson*, a Man brought up from his Youth in Mines, in the Service of Dr. *Bathurst* and Mr. *Squire*. Mr. *Auditor Harley* and I borrowed him of his Grace the *Duke of Somerset*, whose hired Servant he then was, and sent him into the West, to make Searches and Collections for us.

I cannot well dismiss the Subject, without taking some brief Notice, of those which the Miners call *Mock-Ores*, or *Samples of Veins*, as judging them to be *Signs of Ores* lodged somewhere near. That does not always happen, tho' indeed they are commonly found at the Tops of the metallic Veins. The greatest Part of these are very light, porous, and friable; but some there are that are solid, and so ponderous, that they certainly hold Metall, tho' so intimately incorporated with the Mineral Ingredients of the Mass, as not to be extricated, or separated from them, by any Process yet found out. I shall conclude, after I have given the Names of the principal Kinds. These are *Mock-Lead*, *Blind*, *Blend*, *Black-Talk*, or as the *Germans* call it, *Sterile-Nigrum*. *Mock-Tin*, or *Cockle*. *Mock-Copper*, or *Gofsens*, a Cornish Mineral, as is also *Mundick*, a sort of brassy *Marcasit* there. *Mock-Iron*, or *Call*, likewise the Product of *Cornwall*. *Mock-Hæmatites*, *Mock-Sparry*, and *Talky-Ores*.

F I N I S.



LETTERS

Relating to the Method of Fossils.

LETTER I.

T O

Sir ISAAC NEWTON.

A Letter sent along with the Method of Fossils, giving an Account of the Things needful and preparative to the drawing up such a Method. The Difficulties of it, and its Uses.

SIR,



SEND you, with this Letter, a *Tract* relating to the Method of *Fossils*; which, if not your own, is wholly owing to you; it being begun, carried on, and finished at your Request. It is indeed a Work, I tho'

tho' small in Bulk, I hope, not altogether without its Uses. For as it may be of Service, at least to those who have now, for some Time past, taken Pains in observing and collecting Fossils, so it may contribute something towards the Advancement of the Science it self. For a right methodizing of natural Things, and a Distribution of each into their Classes, according to their natural Properties, and mutual Agreement amongst themselves, conduces very much to the more easy and certain Knowledge of them. For which Reason, several very learned Men of late Years, have happily employed themselves, and spent much Time and Labour, in reducing all Kinds of Animals and Vegetables into Method. But Fossils, of however great Worth and Importance, have been much neglected, and left wholly to the Care and Treatment of Miners and meer Mechanicks. 'Tis on this Account that these, having not been yet sufficiently made known and distinguish'd, have lain hitherto in the Dark; till being, Sir, at your Command,
brought

brought forth to Light, I now display, and lay all open to your View.

The Reason that there has been a so much greater Progress made in digesting and methodizing Animals and Vegetables, is, that they are more frequently in View, better, and more readily known. For, in those Bodies, the Marks and Characters, by which the principal Kinds, and subordinate Species are distinguished, being so manifest and apparent, their Affinities or Differences may be discerned with Ease, and almost at first Sight. Whereas, Minerals are of a deeper, and much more abstruse and difficult Inquiry. Of this I shall produce one or two Instances. As the exterior native Complexion, in Samples of even the same Kind of Mineral, is commonly very different; so likewise must the interior Constitution be, by reason of the various extraneous Matter that is commonly incorporated with it in its first Concretion. Nor is there a less Diversity in the Site of Minerals, their Place, and in the Variety

of Matter, among which they are found lodged and repositèd in the Earth.

THAT I might therefore the better extricate my self from these so great Perplexities, and come to some Certainty in this Affair, I proposèd several Ways of Examination and Trial, in order to discover the Nature of such Parts in these Bodies, as do not immediately fall under the Senses. The first of these was, to find out and ascertain the various Degrees of the *Hardness* of each. The next, to make accurate Observations of their various *specific Gravity*. Finally, I tried each by *Fire*, and a *Chymical Analysis*, in order to discover whether they would emit an *Halitus* or *Vapour*, or a *Smoke*, or a *Flame*: Whether they would yield an *Oil*, or a *Salt*: Whether they would be reduced to a *Cinder*, or a *Calx*: Lastly, whether they would run into a *Vitrum*, or into such a Mass, as the Metallists are wont to call a *Regulus*. Besides, as I am not forward to rely on my own Abilities, well knowing how little they are, I thought it proper, in so obscure

scure and intricate a Subject, to confer with some others, who were well vers'd in the Knowledge of Minerals, particularly Mr. *Stonestreet*, whose Sagacity in searching into natural Things, and Success, in methodizing them, I had been long acquainted with. Neither would I, after all, have thus offer'd these my Attempts to a Person of your Judgment, without having first had the Approbation of those others, who are most deservedly in Esteem for their Knowledge in these Studies. If I find what I have here laid before you be not unacceptable, as it will be the highest Satisfaction to me, so will it encourage me, if ever I am so fortunate as to have leisure to lay before you, and, if it be so happy as to have your Approbation, to publish a Natural History of all the Sorts of Fossils, founded on Reflections made upon those I have collected, and the Observations that I have made on others from abroad.

I am, &c.



LETTER II.

To Sir JOHN HOSKYNs Baronet.

The Study of Fossils never hitherto reduced to Rule, nor any Form of Art. The Writers, both the Antients, and those of later Times, have confounded Things buryed in the Earth, with the natural constituent Parts and Productions of it. These distinguish'd, the Ranks of each adjusted, and Fossils divided into Extraneous and Native.

SIR,

I Have little to value my self upon, besides the Goodness I am perpetually receiving from my Friends, and the favourable Opinion they are pleas'd to entertain of my Studies. Nor does any Thing in Life afford me so sensible a Pleasure, as the Reflection that I am able to do any Thing that is not thought wholly unworthy of Acceptance with Men of
the

the Character of those you mention. 'Tis particularly no small Satisfaction to me, to be so far honoured with the Friendship of Mr. *Aglionby*: And, that a Man of his Goodness, and extensive Knowledge, is pleas'd to think me capable of enlarging, or making any Addition to it.

BUT, Sir! you are, I am sure, far from having any need to add that Motive: Or, to put his Commands into the Scale, when you well know of how much Weight yours alone ever are with me. And tho', if I consider how great his Penetration, and yours is, I might be deterr'd from offering any Thing I am able to write to either, I am so far encourag'd by your joint Humanity, that without further Hesitation, I venture freely to lay before both, what comes readily into my Thoughts on the Subject He and You think, and indeed very justly, hath lain hitherto so much in the Dark.

THE several Sorts of Matter, that constitute the terrestrial Part of the Globe we inhabit, are usually comprehended,
and

8 *Letters relating to*

and set forth by the Writers of Natural History, under the general Name of FOSSILS.

THESE are of two Sorts, *extraneous*, and *native*. By *extraneous Fossils*, I intend the various *vegetable Bodies*: As likewise the *Teeth* and *Bones* of *terrestrial Animals*, and the Shells of *Oysters*, *Conchæ*, *Cochleæ*, *Echini*, and other marine Creatures, that are found in great Numbers and Variety, buried in all Parts of the Earth. These, by most late Authors, have been supposed to be found in the Earth, and meer Stones; and treated of as such, under the Names of *Ostracites*, *Conchites*, *Cochlites*, and *Echinites*; which Names occur very frequently in the Writers of Fossils. And, by those Names, sometimes they design meerly the Shells above recited; simple, free, and empty: Sometimes those Shells fill'd with Stony, Flinty, or other like Matter: Sometimes only the Stone, Flint, Spar, or other Mineral Bodies, that were originally formed and moulded in those Sorts of Shells, since perished

and gone: Sometimes the meer Impressions of them in Stone: And not uncommonly, all these promiscuously and indifferently. Which want of Care, and due Examination of these so different Bodies was indeed one great Cause that those Writers fell into that Opinion. But the several *Sorts* of them are now rightly distinguish'd ^a, and the *Origin* of each ascertain'd ^b.

I shall only add here, for the further clearing up of this Matter, the several fanciful Names that have been heretofore given to some of the most remarkable of these Bodies: And, from my own Observations upon them, note what they really are. That commonly call'd *Cornu Ammonis* ^c owes its Form to a turbinated Shell: The *Bucardites* ^d, to a *Bivalve*. Indeed both of them are frequently found actually covered with the very Shells in which they were formed. That Body to

K which

^a *Catalogue of the Fossils of England, &c.* M. S. *Earth. Part 4 and 5.*

^c Plin. xxxvii. 10.

^b Nat. Hist. of the

^d Plin. *ibid.*

which Dr. Plot^e has given the Name of *Tbrichites*, is assuredly only Part of the Shell, of the *Pinna-Kind*, composed of transverse Parallel Fibres not unlike *Hairs*^f, which was the Reason that he confer'd that *Name* upon it. It is found very commonly, and in many Parts of *England*, besides *Shotover*, *Barton*, and the Places he mentions. The Figure of the *Hysterolithus*, of which *Ol. Wormius*^g, and several Naturalists since, have imagin'd such strange Things, is wholly accidental, and taken from a Species of that Kind of Shell to which *Fab. Columna*^h has given the Name of *Concha anomia*; the Inside or Cavity of which this Stone is cast in, and exactly resembles. The *Brontia*, and *Ombria*, of *Geo. Agricola*ⁱ, is an *Echinites*, and form'd in the Shell of the galeated *Echinus Spatagus*. So likewise are those of *J. de Laet*^k; which he supposes to be also the

Che-

^e *Nat. Hist. Oxfordsh.*

c. 5. §. 145. Tab. vii. Fig.

7. & Nat. Hist. Staffordsh.

c. 5. §. 40.

^f *Œgines, Hairs.*

^g *Museum. p 83.*

^h *De Glossopetra.*

ⁱ *De Nat. Fossilium.*

L. 5.

^k *De Gem. L. 2. c 25.*

Chelonites of *Pliny*. Those two grav'd by *Fr. Lachmund*¹ are Stones form'd in a different Species of the *Echinus Spatagus*. That which *J. Kentman* sent to *C. Gesner*, whereof he has given an *Icon*^m, is a Stone moulded in the Shell of an *Echinus Ovarius*. He has also the Figures of two Fossil-Shells of the *Echinus Ovarius*ⁿ, fill'd with Stone. These he takes to be of that Sort that *Pliny* calls *Ovum Anguinum*. The very same *Ol. Wormius* has caus'd to be engrav'd under the Title of *Brontia* or *Ombria*^o. These Kinds of Stones the Country People here in *England* call sometimes *Fairy Stones*, but commonly *Thunder Stones*; in which Fancy they agree with the People of *Germany*^p, and likewise with *Pliny*^q. The Bodies call'd *Tecolithi* by *Pliny*, *Lapides Judaici*, and *Syriaci*, by other Writers, so much celebrated

¹ *De Fossil. Heldesthem.*

p. 23.

^m *De Figuris Lapid.*

p. 61.

ⁿ *ibid.* *p.* 168.

^o *Museum L.* 1. §. 2.

c. 12.

^p *Carmina ex eo nomen invenit quod cum Fulmine, ut credit vulgus cadit. G. Agrico. de Nat. Foss. L.* 5.

^q *L.* 37. *c.* 10.

brated by the antient Physicians for their diuretic Properties, but reputed by all as no other than meer Stones, have been at last publickly demonstrated ^r to be only *elevated Spikes of Echini Ovarii*, brought forth of the Sea at the Deluge, and buried, together with other marine Bodies, in earth. The *Trochi*, *Trochitæ*, and *Entrochi*, as also the *Asteria*, are now finally known to be all likewise owing to the Sea ^f. All the several Kinds of each serve as Cords or Strings to tie the Train or *Cauda* of that surprizingly strange Body the *Stachyoides* ^t to the Shell of the Fish to which it belongs, and serves as a Train and Rudder for Steerage. This *Train* has its Name *Stachyoides*, from its resemblance of an *Ear of Maize*, or *Indian Corn*. 'Tis found commonly among Shells, and other Remains of the Sea, in several Parts of *Germany*: And Mr. *Rosinus* of *Munden* has set forth a Discourse ^u concerning it. I have frequently met with *Parts* of it in
England,

^r Gresham Lecture, read
 May 9. 1693.

^t Στάχυς. Spica.

^f Gresh. Lecture 1693.

^u De Stellis marinis,
 Fossil. 4°. Hamb. 4. 1719.

England, chiefly in the Chalk-Pits in *Surrey* and *Kent*. Mr. *Rosinus* calls the *Stachyoides*, Fossil *Sea-Stars*, I confess I cannot imagin for what Reason. The *Parts* and *Segments* of these Bodies have obtain'd various Names among the Writers of *Fossils*, e. gr. *Eucrinus*, *Pentacrinus*, *Pentagonos* ^x. The Bodies call'd by Mr. *Lhwyd* *Stellaria* ^y, are no other than Parts of the *Stella Arborescens*. The *Glossopetræ* are Teeth chiefly of *Sharks* of various Kinds. The *Plectronita*, or *Rostrage* of Mr. *Lhwyd* ^z, is the Tooth of a strange Sea Fish, not nam'd nor describ'd by the Writers of Fishes. There is in my Collection, a Jaw of this Fish digg'd up, with Teeth of this Kind still actually remaining in it. The *Bufo-nitæ* are Teeth of the *Wolf-Fish* digg'd up in many Countries, along with other *Spolia* of the Sea. These were wont formerly to be worn in Rings, and pretended to have grown in the Heads of *Toads*, whence they had the Name of *Bufo-nii*,

^x Lachmund. de Fossil. Hildeshem. Sect. 3. c. 17. 18.

^y Lithol. Brit. Tab. 14. ^z Lithophylacium Britan. Tab. 16.

*Bufo*ni, and great Virtues ascrib'd to them. Dr. *Merret* ^a, comparing these with those in the Jaws of that Fish, found an exact Agreement betwixt them, and rightly concludes both to be of the same Origin. By this Method he imagin'd he had made a Discovery of a Counterfeit and Imposture of the *Lapidaries* in selling *these Teeth* for the true *Toad-Stones*; suspecting them to be really taken forth of the Jaws of that Fish, and not out of the Heads of Toads, he seeming not to have known that there are naturally no such Stones in the Heads of Toads, that these are really all of them Teeth of the *Wolf-Fish*, tho' thus found in the Earth; and therefore, by those who know not how they came there, reputed natural Stones. The *Siliquastrum* ^b is evidently a bony Substance, and by its Shape and Make appears to have serv'd for Coverture and Guard of the Palate of some Fish, that feeds, as several do, upon Shell-Fish,

^a *Pinax Rerum Nat. Britan. p. 210.*

^b *Mr. Lhwyd Philos. Transf. N^o. 200. and Lithophyl. Brit. p. 73.*

Fish. The *Icthyospendyla*^c are only vertebres or Joints of the Back Bone of Sharks, and other Fishes. The *Turcois*, that hath passed currently thorow all Ages for a meer Stone, is indubitably of *Animal Origin*. The various Samples of it that I have seen, are some of them Fragments of very firm hard Bones, the rest of Teeth, that have imbib'd a Tincture in the Earth, either a dusky Blue, or a greenish. The Teeth of various Kinds of Sea-Fishes, and of amphibious Creatures, as the *Rosmari*, or *Morse*, the *Manati*, and of *Elephants*, left at Land at the Deluge, are sometimes found in digging, both here and Abroad; of which I have various Samples in my Collections. They are nearly of their Native Complexion, where they have not been lodg'd among mineral Matter, that being insinuated into them has superinduced and imparted to them its own Colour. Those lodg'd where there is *Copper* in the Earth, are frequently *blue* or *green*, which Colour that Metal is wont to impart,

^c Lhwyd Lithophyl. Tab. 18.

part, when insinuated in due Quantity: Nay, even when in less Quantity, so that the Body is of its native pale Hue, if expos'd to the Heat of a Fire, to fetch forth the latent Copper Particles, it becomes of a slight *Blue*, or a *Green*. To the Bones and Teeth digg'd up out of the Earth, that retain'd much their native white Colour, or were a little variegated with Black, which all the Fossil Elephants Teeth, that I have seen, are, the antient Naturalists gave the common Name of $\epsilon\lambda\epsilon\phi\alpha\varsigma \delta \omicron\sigma\upsilon\kappa\lambda\acute{o}\varsigma$ ^d, *Ebur Fossile*. To those that had acquired in any Part a bluish Colour, they gave the Name of *Calais*; which, as shall be shewn by and by, is what the later Writers call the *Turcois*. Dr. *Poterius* ^e, finding out that the *Turcois*, which Signior *Pozzo* shew'd him at *Rome*, were really Ivory, tho' disguis'd by the Colour, suspected them to be, because not of real stony Constitution, all counterfeit; which was the very Oversight that Dr. *Merret* fell into in relation to the *Bufo*nites. As these Teeth and
Bones

^d Theophrast. de Lapid. ^e Pharm. Spagy. L. 2. c. 25.

Bones acquire a Colour by a *long* Stay in *cupreous Earth*, they attain it in a much *shorter*, by their lying in *cupreous Water*; this serving *quickly* to introduce the metallic Corpuscles. Such there are in my Collection, taken out of the Currents of Water that flow forth of the *Copper Mines* of *Herugrundt* in *Hungary*, and of *Goldscalp* in *Cumberland*. Tho' *F. Hardouin*^f doubts of that, *Salmastius*^g, and *Johan de Laet*^h, who had both of them much better consider'd, and been more conversant with Fossils than that learned Critick and Commentator, take the *Callais* of the Antients for our *Turcois*; and, I think, with very good Reason. *Plin.* L. 37. c. 33. *Callais e viridi pallens, fistulosa, & sordium plena, —leviter adherens, nec ut agnata Petris, sed ut apposita, —fragilis. Optimus color smaragdi.* 'Tis not possible any Description should better answer the *Turcois*; which being a Tooth or Bone, that has lain long in the Earth, must

L needs

^f Not. in *Plin.* xxxvii. 33.

^g *Exerc. ad Solin.*

^h *De Lapid. & Gem. L. I. c. 25.*

needs be softer and more *brittle* than real Stones, as also *foul*, as being somewhat *porous*, which Teeth and Bones naturally are. Nor can it be *united*, and of a Piece with the Rock, wherein 'tis only lodged, but *slightly adhering* to it. Then the *Callais* was found in the same Places, where we find our *Turcois*. As to the Colour, *Pliny* represents it here like that of the *Emerald*; by which *Cæsalpinus* shews ⁱ he means a *Sky-Colour*, or *Blue-grey*. *Pliny* elsewhere ^k represents the *Callais* as nearly approaching the *Sapphire*, but paler, and of a *Sea-Green*; which exactly suits the *Turcois*. And *Salmasius* well observes, that the very Name shews it to be of a *purpleish* ^l, or blue Colour. The *Hammities*, composed usually of multitudes of small globular Bodies, is wholly made up of a *Congeries* of the *Vesiculæ* of the *Ova* of various Kinds of *Fishes*, fill'd with a fine hard arenaceous Substance. That they resembled

ⁱ *De Metallis* L. 2.

^k *Nat. Hist.* xxxvii. 56. *Callais Sapphirum imitatur, candidior, & litoroso mari similis.*

^l *Καμαίον Exerc. in Solin.*

bled those *Ova*, was indeed very early taken notice of ^m.

THOSE, which I have been hitherto displaying before you, Sir! are the chief Particulars, I would note to you relating to the *extraneous Fossils*: And as to the *Native*, the Writers having been so little accurate as, you see, to confound Bodies of so very different Origin and Constitution with them, it cannot be thought strange, that their Accounts of the *native Fossils* themselves should be frequently erroneous and imperfect. In assigning their very Names, they give us commonly the same Body under different Names; as they do different ones under the same Name. Then in their Methodizing and ranging of the native Fossils, 'tis no wonder that they fail, and that all Things are in Disorder, and out of Course with them, when they so frequently make Choice of Characters, to rank them by, that are wholly accidental, and unphilosophical; as having no Founda-

L 2 tion

^m Hammites Ovis Piscium similis est, *Plin. Nat. Hist. L. 37. c. 10.*

tion in Nature, or the Constitution of the Bodies themselves. Thus some rank them under the Heads of *common*, and *rare*, of *mean* and *pretious*: of less, and of greater *Use*. Then they reduce them to *subordinate Classes*, according to their particular *Uses*, in Medicine, Surgery, Painting, Smithery, and the like; which would be proper in an History of *Arts*, or *Mechanics*; but serves only to mislead them and their Readers in the History of *Nature*. Besides, they rank, amongst the rest, Bodies that are Mineral indeed, but *factitious*, and not in their native Condition. An Instance of this we have in the *Pumex*, which almost all the Writers of *Stones* place amongst *them*; whereas 'tis in Reality nothing but a *Slag* or *Cinder*, found either where *Forges* of Metalls have antiently been; or near *Ætna*, *Vesuvius*, or some other burning Mountain, forth of which it has been cast. Another Example of this we have in the *Lapis Spongiæ*, which is a light, porose, friable Body, compos'd of a Matter chiefly *Corallin*, and generally
made

made into the Form we find it, by a *marine Insect*.

BUT these are only a few of the many Instances that might be alledged to evince in how uncertain and perplex'd a Condition this Study has hitherto lain: And how little Light into the Nature of Fossils, and their Relation to one another, we are to expect from those that have heretofore wrote. The classical Disposal of the native Fossils will indeed ever be a Work of Difficulty. It hath been prov'd from Observations ⁿ, made on the present Condition of them, that they have been once all in a State of Solution and Disorder: And such is the present Constitution of them that it is very hard, if not impracticable, to rank and reduce them into an exact Method ^o. For they want those fix'd Characters of Affinity or Disagreement that Animals, and that Vegetables carry along with them. It hath been shewn, how little Certainty there is in their Colour and Figure, in
their

ⁿ *Nat. Hist. Earth, Part 2.*

^o *Vid. Nat. Hist. Earth, Part 4. sub initio.*

their Situation in the Earth, and their Mixtures with each other ^p. And few of them being pure, or unmix'd, 'tis plain there can be no determinate Rule as to their *specific Gravity*, their *Consistence*, or Approach more or less to *Solidity*, or as to their Constitution. In fine, there being no single Character steady, or to be rely'd upon, I am oblig'd to make Use of one or other of them, as I see most fit, and conducing to my Purpose. My chief Regard is, to the Nature and *constituent Matter* of each; but since that Matter is frequently mix'd, and various in the same Sort of Body, I conduct myself by such other *natural Notes* as present themselves, and all such *Tests* and *Methods of Scrutiny*, as I find practicable. In particular, I have Regard to the *Bulk* each Sort of Fossil is naturally of: Also to its comparative *Gravity*, *Density*, *Solidity*, the *Grossness*, or *Fineness* of the Parts: The natural *Figure* of the form'd Stones, and other Bodies, their *Texture* and *Constitution*; as likewise

^p Ibid.

likewise the *Colours* observable in many Sorts of Fossils, the *Diaphaneity*, or *Opakeness*: Their Disposition to a *Solution* and Mixture with Water. Lastly, I consider in what Manner they affect the Organs of Sense, the *Smell* and the *Taste*; as also the *Touch*, as to their Roughness, Harshness, Smoothness, and their being unctuous, oily, and the like. With this Conduct, and assisted by these Lights, I range the native Fossils in the following Method. 1. *Earths*. 2. *Stones*. 3. *Salts*. 4. *Bitumens*. 5. *Minerals*, or Bodies nearly approaching the Nature of Metals. And, 6. *Metalls* themselves. The particular Reasons for my adjusting them thus, you will be better Judge of, when you come to see the Detail of the whole Method.

I am, Sir, &c.



LETTER III.

To the same.

Of the Cerauniaë, or Stone-Weapons, the Magical Gemms, and some other artificial Things antiently in Use, imagin'd by many late Writers to be natural: With Icons of several of those in my Collection, brought from most Parts of the known World.

SIR,

IT must be allow'd, that I had the more Reason to attempt the *Natural History of the Earth*, and of the Bodies found in it, both *native* and *extraneous*, because, as you observe, this Study had all along lain in the greatest Darknes and Confusion: And, to the very Time that I fet forth that Work, it was *not yet agreed among the Learned, whether these Bodies formerly call'd Petrify'd Shells, but now-a-days passing by the Names of formed Stones,*

Stones, be original Productions of Nature, form'd in Imitation of the Shells of Fishes, or the Shells themselves ^p. Indeed the latest Writers of all were positive that these Bodies were not *real*. Dr. *Lister* ^q asserts point blank they were *never any Part of an Animal*, being only *Resemblances of Shells*, but *meer Stones*, which the *Earth produces*, and each *shap'd by the Power inherent in the Stone*, or in it self. This must needs be allowed by all who have made any Observations of the Productions of Nature in the Formation of Bodies, tho' they have not made many Observations on these, to be a Doctrine, however positively delivered, very mysterious and paradoxical. Be that as it will, not only Dr. *Lister*, Dr. *Plot*, and others here, but learned Men Abroad, fell generally into it. Nay, so Zealous were they bent upon it, and strongly possessed with it, as to imagin not only the animal and vegetable Bodies, found lodg'd in the Earth, but several

M

artificial

^p *Mr. Ray's 3 Discourses* 8°. Lond. 1693. p. 127.

^q *Philos. Transf.* N°. 76. *Cont. Lib. Cochlitarum Angliæ* 4°.

artificial Things, antient *Urns*, and other *Vases*, *Stone-Weapons*, and *Magical-Gemms*, to be productions of it, and formed by Nature under Ground; which may pass for one of the many surprising Instances there are of Precipitation, Credulity, and want of Judgment in these Writers; and I wish there were not so many likewise in all the other Parts of natural History; that a Man that would be accurate in any, can hardly tell what to rely upon, without bringing all, of the very much that hath been written, to the Test anew. I have formerly had Occasion to make some Reflections on the Notion ^r of the *Fossil-Urns*; and since I have your Commands for it, I shall here offer something concerning the Antient *Magical Gemms*, and *Stone-Weapons*.

Dr. *Lister* ^f supposes these Gemms to be *Ombriæ*; and with his usual Warmth and Positiveness, pronounces them *figur'd*

^r *Nat. Hist. Telluris defensa contra Camerar. p. and Mr. Holloway's Translation, p. 154.*

^f *Philos. Transf. No. 201.*

gur'd naturally, and without any Artifice: Nay, and which is a very pretty Fancy, *naturally polish'd too*, with just as much Reason as he might a *Table Diamond*, a *Brillant*, or an *Intaglia* of *Julius Cæsar*. But you know, Sir! this learned Gentleman having set forth in his Youth, with the Notion, that all Bodies of regular and determinate Figure, found in the Earth, were form'd there, abid by it stily to the End; this being the very last Paper he publish'd on this Subject. Writers for Fame, great Souls! are ever constantly in the Right, and will sooner give up their Lives than their Opinions; even tho' they first take them up frequently upon meer Fancy, or very slight Grounds; while those, who really search after *Truth*, are very wary in what they advance; and with great Readiness and Candor submit all to the strictest Scrutiny, attending as well to every Thing that may be offer'd against it, as for it. As to the Bodies you are so desirous of an Account of, they have pass'd from the remotest Antiquity downwards, under the Notion and Title of

Magical-Stones, or *Gemms*. They are, to this Day, sometimes found broad in our fields. I have seen only three Kinds of them, and keep a fair Sample of each in my Collection. Neither any other Writer, nor Dr. *Lister*, mentions any more: And his are indeed the same with mine; so that I am apt to believe there are no more. My first is, of an exactly spherical Form, near two Inches in Diameter. The second is a *Spheroid*, much compress'd, 1 Inch $\frac{4}{5}$ in Diameter, and $\frac{7}{8}$ in Perpendicular. The third is oblong, round off at each end, with a Basis somewhat convex, and two Sides also a little swelling and convex, the upper Part terminating in a Ridge. This Stone is two inches in Length, and $1\frac{3}{4}$ in Diameter. 'Twas found near *Barkhamstead* in *Middlesex*, and possess'd long, indeed to his Death, by an eminent Physician there. 'Twas made use of by him as a *magical Speculum*; he giving out to his Patients, that *Something* was wont to *discover* it self to him in *this Stone*, by which he receiv'd Light and Informations, on such Occasions as he inspect'd and consulted it.

He

He left a great *Estate* to his *Son*; who not being ever able, with both his Eyes, to discover that *Spectrum*; instead of getting an *Estate*, spent the greatest Part of that which his Father left him; and was pleas'd to do me the Honour to send the Stone to me, who being not so happy as to be possess'd of *Faculties* equal to those of the wise good old *Gentleman*, can no more discern the *Spectrum*, nor get an *Estate* by it, than the generous frank young *Gentleman* his *Son* could.

THESE three Stones are all form'd out of that Sort that the Lapidaries call *Peble-Crystal*; which is found in several Parts of *England*; and are very fair, pellucid, and clear. The first is indeed of a fine deep Water, and is a very beautiful Stone; being of a spherical Figure, it might be taken for a *Pearl*: And Dr. *Lister*^r says, that these are call'd in some antient *Leases*, *Mineral-Pearl*. In former Times, they must of Course be, before

fore they were pick'd up, more frequent, particularly in *Britain*: And 'tis not altogether improbable, that these are of those mention'd by *Suetonius* ^u as found antiently here, and suppos'd by the *Romans* to be *Pearls*, but of an *extraordinary Bigness* ^x; these being indeed vastly more large than any of the true *Pearls*. most of these Stones, and particularly the three above mention'd, are so regularly cut, and polished in a manner so exquisite, that I can hardly imagine how a people so barbarous, and destitute of all Working-Tools, ^y could ever finish them with so great Elegance and Exactness. When first I observ'd these Stones, I conjectur'd they might be us'd meerly as *Gemms*, and worn antiently for Ornament by the Natives. But Mr. *Aubrey*, who, you know Sir! hath much studyed the Antiquities of this Island, contends that they were us'd in *Magick* by the *Druids*: And, in his *Miscellanies* ^z, he takes notice of a *Crystal Sphere*, such as the first of these is, or *mineral Pearl*,
us'd

^u *In Casare* §. 47. ^x *Sueton. Ibid.* ^y *Conf. State of London*, 8°. §. ——— ^z 8°. *Lond. 1696. Page 128.*

us'd by Magicians, and to be inspected by a Boy. But, long before him, Joach. Camerarius^a mentions a round Crystallin Gemm, into which a chaste Boy looking, discern'd an Apparition, that shew'd him any thing that was required or sought for. Paracelsus^b carries the Thing further, and avers, that in these *specula* are seen Things past, present, and to come: And that some Star impresses on the Crystal an Image of its Influence, and a Similitude of the Thing inquired and look'd for in it. And of this Sort were the Crystallin Stones made use of by Dr. Dee, and Mr. Kelly in their mysterious Visions and Operations; of which they drew up a Journal, since publish'd by Dr. Meric Causabon^c. One of theirs was round, of a pretty Bigness, and of Crystal; very probably the same with my first. This they call the *Shew-Stone*, and *Holy-Stone*. You see, Sir! from these Foole-ries having held and been kept up thus, from the most early Times, in a continued

^a *Pref. in* Plutarch. de Defectu Orac.

^b *Explic. Astron.*

^c *Relation of Dr. Dee, &c. Fol. London 1659.*

nued Tradition, quite down to our own, while Things the most highly rational have been neglected, dropp'd and fallen into Disuse, how fond Mankind hath ever been addicted and prone to Superstition; of which there are but too many other Instances.

As to the Antients, from the Writers of those Times, we learn, that the *Zoraniscos* was a *Gemm* us'd by the *Magi*^d, as also the *Heliotropium*^e; with a great Number of others, not needful to be recounted here. Those which come the nearest to ours, and from which the superstitious Use of these seems to be derived, are of the *Star-Stone*, or *Astroite* Kinds. Not of those of the later Naturalists, which had their Names from their Figure, or some Delineations upon them, resembling the Stars of Painters and Heralds, but of those of the Ancients which were lucid and transparent; and therefore were said to *shine like a Star*, whence they had their Name.

—καλα

^d Zoraniscos Magorum Gemma. *Plin.* xxxvii. 10.

^e Ibid. xxii. 29.

—κατὰ σκοπιάς Παλλήνης
 φέλει Ἀσέριος, καλὸς λίθος, οἷα τις Ἀσιρ
 μαρμαῖρων †.

IN like Manner the *Star-Stone* of *Pliny* was white, or nearly approaching the Transparency of *Crystal*, and supposed to have its Name from *reflecting back the Light of a Star, when exposed to it* †. The same Author treating, if not of this, of a nearly related Species of *Star-Stone*, which he ranks likewise amongst the transparent Gemms, tells us that 'twas in *mighty Esteem*, and that *Zoroaster*, one of the most celebrated of all the *oriental Magi*, had set forth its wonderful *Efficacy in magical Arts* †. The same Author observes, that the *Asteria* was a pretty hard Stone, and that the *Lapidaries* found some Difficulty in the cutting.

N of

† Dionys. περιηγ. 327. opposita Fulgorem rapiat ac regerat. *Plin.* xxxvii. 9.
 ‡ Candida est vocatur Asterios, Crystallo propinquans, in India nascens, & in Pallenes Litoribus—Causam Nominis reddunt quod Astris
 † Celebrant & Astroitem, mirasq; Laudes ejus in Magicis Artibus Zoroastrem cecinisse, *Plin.* xxxvii. 49.

of it; which is likewise the Case of these Stones. So that those of the Antients apparently agree with these as to their Constitution, their Complexion and Diaphaneity, as well as the superstitious Uses they were applied to: And I take notice of one Species of *Star-Stone* in the same Author, that was likewise *orbicular*, and of the very same Shape ⁱ with the first of mine. I'm not a little displeas'd with my self, that I have, before I was aware, taken up so much of that Time which, Sir, you know so well how to imploy better, and run on thus far on a Subject so very slight. But I shall dismiss it, after I have offer'd you a Conjecture at the Reason why this Kind of Stone has been employ'd thus as a *Speculum*, and turn'd to Magical Delusion, and the spying out of *Spectra*. It most probably happen'd from the *Constitution* of the Stone; which, in every various Position, gives a various Coruscation, and Glare of the Light; and, by that Means, a various Representation of
Things

Things, and Entertainment of the Fancy. Which Conjecture I am led into by their own Descriptions and Accounts; wherein they set forth the *Glittering and Light* of the Star-Stone, which they compare sometimes to that of the *Sight of the Eye*, sometimes to *the Moon at full*; and take notice besides, of its reflecting the *Light* of a *Star*, or of the *Sun*, when exposed to either ^k.

IN like Manner the *Selenites*, or *Moon-Stone* of the *Antients* was *white*, or *transparent* ^l, and had its Name from representing the *Moon*, as in a Glass, as *Pliny*, *Gesner* ^m, *Agricola* ⁿ, and Dr. *Plot* ^o observe; tho', for the same Reason, it might as well have been call'd the *Sun-Stone*, it as readily representing that, or any other luminous Body; and therefore had likewise the Name of *Lapis-Specularis*, as Dr. *Plot* takes Notice. And as the *Astroites* was used in Ma-

N 2

gick,

^k *Plin. L. 37.*

^l *Plin. ibid.* & *Dioscorid. ὑλησ ἀλας. v. 159.*

^m *De Fig. Lapid.*

De Nat. Fossil. L. 5.

Nat. Hist. Oxf. c. 5.

gick, amongst the *Antients*, so the *Se-lenites* was used by them as a *Charm* or *Amulet* ^P.

You'll imagine, Sir! treating of these Things, 'twill not be easy for me, not to recollect the so justly celebrated and illustrious *Oracle* of the *Jewish Nation*, that pass'd among them, under the Name of *Urim and Thummim*, or *Lights* and *Perfections*, for such those Words import. This was compos'd of *twelve Gemms*, artfully join'd together, and worn on the High-Priests *Pectorale*. 'Tis thought, whether rightly or not I take not upon me here to determine, by the best Judges of the *Jewish* Antiquities, that those who consulted this *Oracle*, looking intently upon it, receiv'd Answers and Resolves by some new and unusual *Lights* and Irradiations then miraculously exerted and cast forth by those *Gemms*. The *Fame* of a Thing so surprizing and extraordinary could not but pass Abroad to the neighbouring Oriental Nations; and

[^P Φυλακίηλοι, πελαμμα. Diosecrid. L. 6.

and 'tis not wholly improbable, that the *Zoroastrian*, and other like *Gemms*, were made in Imitation of this, and took their first Rise from it. 'Twill not be thought Strange, that they should all differ so much from this, when 'tis known that the *Jews* treated all the other Nations in a manner very supercilious, and were shy of imparting any Thing to them; so that the Tradition and Account they receiv'd of it must needs be very lame and imperfect.

I come next, Sir! in Pursuit of your Commands, to give some Account of the *Stone-Weapons* and *Instruments*. Now, tho' these carry in them so plain Tokens of *Art*, and their Shapes be such as apparently to point forth, to any Man that rightly considers them, the *Use* each was destin'd to; yet some of the Writers of Fossils, and of great Name too, have been so sanguine and hasty, so much blinded by the Strength of their own Fancy, and prepossessed in Favour of their Schemes and Notions, that they have set forth these Bodies as natural Productions
of

of the Earth, under the Names of *Ceraunia*. Of this Sort are the *Ceraunia* of which we have *Icons* in *C. Gesner* ^q, *A. Boetius* ^r, *M. R. Besler* ^f, *Ol. Wörmius* ^t, *S. L. Moscardi* ^u, and *Fr. Lachmund* ^x. And *J. Kentman* ^y hath left us a Description of four of these, likewise, under the Names of *Ceraunia*. The Authors here recited, imagine these to be the *Ceraunia* of the *Antients*. Probably they may be those of *Sotacus* ^z; but what the *Ceraunia* of *Pliny* were, it is not easy to conjecture from his Account of them ^a. He supposes them to fall with *Showers* and *Thunder*. As he does likewise

^q *De Tig. Lapid. p. 62.*
64.

^r *Hist. Gem. L. 2. c.*
261.

^f *Gazophyl. Rer. Nat.*
Tab. 34.

^t *Museum. L. I. Sect.*
2. c. 12.

^u *Musæo Moscardo L.*
2. c. 50.

^x *De Fossil. Hildeshem.*
p. 23.

^y *Nomenclat. Fossil.*
Misnia p. 30.

^z *Sotacus & alia duo*

genera fecit *Ceraunia*, nigras rubentesq; ac similes eas esse *Securibus*; per illas quæ nigrae sunt & rotundæ *Urbes* expugnari & *Classes*, easque *Betulos* vocari: quæ vero longæ sunt, *Ceraunias*, *Plin. L.*
37. p. 737.

^a Est inter candidas & quæ *Ceraunea* vocatur, fulgorem siderum rapiens. Ipsa *CrySTALLINA* splendoris cœrulei. *Plin. L. 37.*
p. 737.

wife the *Ombria*, and *Brontia*^b: Of the *Ombria* he gives no Description, and a very obscure one of the *Brontia*; he only comparing it to the *Head* of a *Tortoise*^c; as he does also the *Chelonitis*^d.

THE *Stone-Weapons*, and *Instruments* were all cut out, and made, before the Discovery of Iron. But, when once this Metal was brought to Light, and its *Uses* known, 'twas found so much preferable in every Respect, that those Stones were presently cast away: And they are those which we still sometimes find A-broad in the Fields, not only here in *England*, but in *Scotland* likewise, and *Ireland*, and *Germany*, and several other Countries; where they serv'd, in the most early Ages, for Axes, Wedges, Chizels, Heads of Arrows, Darts, and Lances. Nay, among Nations yet barbarous, and unacquainted with the Manufacture of Iron, and that have not been discover'd
by

^b *Ombria* sicut *Ceraunia*, & *Brontia* cadere cum *Imbribus* & *Fulminibus* dicitur, *Plin. L.* 37. c. 10.

^c *Brontia* capitibus *Testudinum* similis *Plin. L.* 37.

^d *Chelonitides* *testudinum* similes. *Plin. L.* 37.

by the *European* Navigations, till of late Years, these *Stone-Weapons* and *Instruments* are in Use to this Day; e. gr. in the Island of *Guam*, one of the *Ladrones*, and in *Nova-Britannia*, an Island lying *South* of the *Æquator*, and the farthest East of any yet known, discover'd a few Years ago by *Captain Dampier*. Indeed, when the *Spaniards* made their first Descent upon *America*, they found no *other* amongst any of all the Nations of that vast Continent, or the Islands adjacent. For, tho' the *Americans* had in many Parts *Iron-Ore*, very good, and in great Plenty, they knew not the Use of it, till they were taught that by the *Spaniards*. In my *Discourse of the Peopleing of America*^e, I have shewn, that *that Colony* was departed, and had left the *old World* before *Iron* was found out, and the *Uses of it* known there. They are so many and great, and this Metall of such Importance, that, had the *American Colony* been acquainted with it, before
their

^e Of this there is since set forth a brief *Extract*. *Nat. Hist. Earth illustrated*. p. 105. & *Seq.*

their Departure, they would never have again lost or forgot it. Perhaps, Sir! you may say, that there were *Iron Instruments* in the World long before, even before the Deluge; which we learn from the History of *Tubal Cain*, who was then *an Instructor of every Artificer in Brass and Iron*^f. Now these must be known to *Noah*, and all his Sons, by whom the *whole World* was peopled. But those *Instruments* all perish'd, and were destroy'd, during the *Deluge*. I have shewn elsewhere^g, that all *Metallic and Mineral Bodies* were then dissolv'd: And, tho' it be there so clearly made out, from Observations, that none be still wanting, this affords an *additional Proof* of the *Certainty* of that *Proposition*. From the most indubitably authentick Monuments that can be required, we know that the *Use of Iron* was not recovered in *Asia*, whence it pass'd to *Europe*, and the rest of the *Old-World*, till some *Ages after the Deluge*: Nor in *America*, till the *Spaniards* made their Descent upon it, two or three Centuries

O

^f *Gen. iv. 22.* ^g *Nat. Hist. Earth. Part. iv.*

turies ago. And tho' *Noah* and his Sons could not but remember the Iron in Use *before the Deluge*; yet so great Havock and Devastation was made, during that so fatal and terrible Catastrophe, and so unhappy a Change in the Earth, that there was every where a new Face of Things, in which they must be much to seek, and reduced to the greatest Distress, Exigence and Necessities^h. They must, in such a State, be fully taken up meerly in providing Food, and the common Supports of Life; and would have little leisure to look after Arts, and Things of remoter Use, till Mankind were further multiplied, and their Affairs on a better Foot. In this so calamitous a Condition, *Iron* might be perfectly *forgot*, and the Knowledge of it quite worn out.

'Tis remarkable, Sir! that, of these antient *Stone-Weapons* and *Instruments*, many are shap'd with great *Regularity* and *Art*, and finish'd with an *Exactness* very surprizing, considering they then had

^h *Conf. Nat. Hist. Earth. Part 1.*

had not the Assistance and Advantage of the *Tools* that we now have. The *Arrow-heads* are particularly remarkable. They are of a Form the most mischievous, and fitted to hurt, that could be possibly devised. They are brought to an exquisitely sharp Point, keen Edges, and have Snaggs, or, as they are call'd, Beards, on each Side, on Purpose that they may make a large Wound wherever they enter, and not be drawn out again without much Difficulty and Harm to the Part in which they happen to be infix'd. 'Tis further remarkable, that the *Arrow-heads*, found in Countries the most distant each from other, e. gr. *Britain*, and the Country bordering on the *Streights of Magellan*, are of the *same mischievous Form*. 'Tis true, different Men having in View the same Design, conducting their Thoughts in a regular Manner, may come, in the Pursuit, to the same Conclusion; and, as in this Case, hit on the same Shape for a Weapon of such Design. But it is much more likely, that they came all from the same Origin; and that the *first Module* was brought from

Babel, to the various Countries whither the several Colonies, sent thence, made their Migrations.

Give me Leave, Sir! to take notice by the by, that some may perhaps think strange, that such a Building as that of *Babel* should ever be set about by Men that had not the Use and Assistance of Iron. But this, like the other most antient Buildings of those Parts, was of *Brick*; in which Iron Tools are not so needful as in Buildings of *Stone*. And yet I have Reason to believe, that the vastest of this later Kind that the World ever saw, I mean, the *great Pyramid* in *Egypt*, was rais'd before the Managery of that Metall was again recover'd and found out. Be that as it will, 'tis most certain, that the Buildings, that the *Spaniards* found out at their first Arrival in *Peru*, were rais'd and finish'd wholly *without the Assistance of Iron*. And yet several of these were so magnificent, and some of the *Stones* so very *large*, as almost to amaze the *Spaniards*. What added to the Surprize, was, that all were very *regularly wrought*,

wrought, squared, and the Joints so closed and fitted, as hardly to be discern'd; in so much that the whole appear'd as if cut out of only one huge Mass of Stone.

By Means of a Multitude of Hands, and united Strength, with continued Labour and Industry, a right Invention and Contrivance, Things surprizingly great have been perform'd even by Nations the most barbarous, savage, and wholly destitute of Instruments and Machines. As to those Buildings, 'tis probable the *Peruvians* squared and smoothed the Stones by *rubbing* them against one another; and raised them up into their Ranks and Places by Assistance of *Heaps of Sand* or *Earth*, gradually piled up on the outside of the Walls of these Buildings.

'Tis late: And, which, I fear, you'll but too easily collect from what, presuming on your usual Indulgence, I thus venture to send you, I am very sleepy; which falls out the more fortunately to you, as it prevents your further Trouble.

I am, Sir, &c.

LET-



NUMBER IV.

An Extract out of the Preface of one of the Catalogues of my Fossils, containing Directions for registering of the native Fossils, and composing an instructive and useful Catalogue of them.

THESE Fossils ought first of all to be digested into Classes, and enter'd in a proper Series and *Method*, according to their mutual Relations and Alliances. Then the *History* of each should be given; so far as there can be any Knowledge or Information of it obtain'd; with an Account *where it was found*, at what *Depth* in the Earth, what *other Bodies* or *Matter* it was attended with, in *what Manner it lay*, whether in a *Fissure*, or in a *Stratum*; with all other Circumstances of the Place. Next should be noted every Thing observable in the Body it self; its *Colour*, its *Figure*, *Texture*, or the Manner of the Concretion of

of the Parts; and the *different Sorts of Matter* that concur, and are united in the same Mass. *Finally*, each single Body should be brought to the *Fire*, to *chymical Trials*, and all other Tests; in order thorowly to discover its *Nature, Constitution, Properties*, and various *Uses*. Was this once effectually done, and just *Deductions* and *Inferences* made from the Whole, 'twould go a great Way towards a *Natural History of Fossils*, and the perfecting this Knowledge. Of the great Profit and Usefulness of these Studies to the Publick, I have spoke fully, and given many Instances elsewhere. What adds further to their Advantage is, that they are not only *enter-taining and pleasant*, but if the Compiler be accurate, they must be *clear* likewise, sure, and little liable to Error and Imposition. *Mathematical Propositions* are ordinarily abstracted; require great Extent of Thought, and Application of Mind. Whereas these *Mineral Propositions* are plain, simple, and obvious. The Relations of the Site and Circumstances of the Fossils in the Earth, and of the various

various Experiments made upon them; are no other than so many *Histories of Fact*. The Accounts of all Things observable in the Fossils themselves, will carry with them *Evidence of Sense*; which is the *highest Certainty*. These Fossils will be so many standing *Monuments*, that give *perpetual Attestation* to this: And there can need no other *Proof* of those *Accounts* than only simple *View* of the *Things* set forth in the *Catalogues*. Nor, finally, can it be difficult to discern, whether the *Conclusions* drawn from those Relations, Experiments, and Accounts, *follow rightly* from them, or not.





NUMBER V.

To Mr. ———

The Assistance that this, and several other learned Men have given to the carrying on the Design of the N. H. E.

SIR,

THERE are not many in this Age, who have taken the Pains that you have done, very happily and successfully, in most Parts of useful Learning; but more particularly in the Study of the *Natural History of the Earth*, and of *Fossils*. The Example and Countenance of a Gentleman of your Distinction and right good Sense, has been an additional Confirmation and Incitement of me; and the Communications that I have from Time to Time receiv'd from you, have given me no little Light and Assistance. Such Part of my Labours, as I have submitted to the Judgment of the Publick,

P

have

have met with greater Opposition from some, they best know why, than I had Reason to expect. But when I consider'd what it was that they urg'd, it rather afforded me Reason to believe what I was doing was right, and confirm'd me in the Pursuit of it.

Tu ne cede malis, sed contra audentior ito.

I can easily pass by Opinionatry, Ill-nature, and the busy meddling of those who thrust themselves into every Thing, how little Knowledge soever they may have of any Thing, while I have the Approbation of Men of your Candour and Accomplishment. Nothing can give me higher Encouragement. 'Tis for the Satisfaction of such only that I was concern'd: And, having attain'd that, I have my End. What you write in your last, *that having had Occasion several Times to pass and repass the Alps, where such vast Tracts of the interior Parts of the Earth are display'd, and laid open to view, and various Opportunities for several Years*
past,

past, of making Observations in many other Places, you are perfectly convinc'd of the Truth of these Observations that I have publish'd in my natural History of the Earth: And that, after having carefully consider'd them, you are as fully satisfied in the Conclusions that I have drawn thence: And that mine is the only Hypothesis that answers Nature, and solves all the Phænomena observable in the Earth, in an easy and Geometrical Manner. This, I say, keeps me in Countenance, and is a sufficient Support to me against other Gainfayers: And 'tis with no little Satisfaction that I take notice to you, that from what they print and declare, 'tis evident, that the Impartial all over Europe have the same Sentiments. It must be allowed a fair Presumption in Favour of the Truth of my Doctrines, that they have abid a very rigorous Test now for above thirty Years, stand yet firm; and the longer and more strictly they are look'd into, the more they are confirm'd to this very Day. Give me Leave to lay before you the Opinion of one that is still actually engag'd in these

Searches, very curious, a good Judge, and has carry'd them on over a great Part of the Globe, from *Numidia*, along the northern Parts of *Africa*, by the Ruins of old *Carthage*, quite on to *Egypt*, to *Arabia*, *Phœnicia*, *Syria* and *Palestine*; Countries from which we have hitherto had very few Accounts. This is Mr. *Thomas Shaw*, Fellow of *Queens College* in *Oxford*. The Words of his Letter to me, *June 1. 1726*, are, — *Wherever I have been, I have had such convincing Proofs of what you advance in your natural History of the Earth, that my Voyages are only imperfect Comments, and smaller Testimonies of what you have elsewhere much better observed.* I am sure a Person of your Curiosity, will be pleas'd to know one Particular, which this ingenious Gentleman acquaints me with in another of his Letters. As he was making Observations upon the *great Pyramid*, he took notice of *Shells*, and other *Marine Bodies*, lodg'd in great Variety and Abundance, in the Mass of the Stone, of which that Pyramid is built, and in that of the Rock wherein it stands, which

which is of the same Sort, and indeed in other Parts of the Country; which was observ'd of the Mountains of *Egypt* 2000 Years ago by *Aristotle*, and others of the Antients. Now this *Pyramid* is one of the first *Structures* that was rais'd after the *Deluge*. Indeed it was built within 250 Years of the Time of that great *Catastrophe*, when, you know, I have asserted those Shells were brought forth of the Sea, and repositied in the Strata of *Earth*, and of the Sand, that afterwards gradually hardned into Stone. Mr. *Shaw's* Observation must be allow'd a considerable Confirmation of my Doctrine. The *Marine Bodies* in the Stone of the *Pyramid*, carry the Thing to near the Time I propose: And those in the Strata of the Rock underneath, quite to it, and up to the very Time of the Compilation of those Strata; which was during the Deluge^a. The learned and ingenious *Steno*^b made a like Observation in the vast Stones in the *Ruins* of the *Walls* of *Volaterre* in *Tuscany*. In these
he

^a N. H. E. Part 2.

^b De solido intra solidum. 4^{to} Flor. 1669.

he found incorporated all Sorts of Sea Shells; which therefore must have been existent before the Time that those *Walls* were built, which was several Centuries before the Building of *Rome*; and that carries them back to within not many Years of the Time of the *universal Deluge*.

As you Sir! and Mr. *Shaw*, so some others of the greatest Men in *Europe*, from the Time that my *Natural History of the Earth* first came forth, have done me the Honour to assist me in the carrying on that Work, at their no small Pains and Expence. Of these Dr. *Scheuchzer* Professor of Mathematicks at *Zurich* is one. You are well acquainted with his Person, his Works, and his great Merits. Dr. *Leopold* of *Lubeck* is another; who finding my Collection not sufficiently stored with *Swedish Fossils*, and that I had not a satisfactory Account of the *Mines* there, of his own Accord, and at his own Expence, undertook a Journey thither for my Satisfaction; with what Success you may see

see in a Letter that he was pleas'd to address to me, *De Itinere suo Suecico*, in *octavo*, in the Year 1720. That celebrated Divine Dr. *a Melle*, of the same City, whose Writings in Divinity, History, and Antiquity, have raised him into so high Esteem in the whole learned World, was induced by the Perusal of my *N. H. E.* to turn his Thoughts to the Study of *Fossils*. The first Fruit of those Studies was his *Epistola de Echinitis Wagricis*, 4^o. *Lub.* 1718. which he did me the Honour to address to me: As did likewise the ingenious and curious Mr. *Linckus* of *Lipsick* his *Epistola de sceleto Crocodili in Lapide* 4^{to}. *Lips.* 1718. The Count *de Schouberg*, Lord Chamberlain to King *Augustus*, and Superintendant of the Mines in *Saxony*, the richest and greatest in all *Germany*, sent me Samples of the Minerals and Ores there, with their proper Names, and those by which they are known to the *Miners*; whereby I was enabled rightly to understand the Writings of *Kentman*, *Agricola*, and others the most learned, accurate, and experienc'd *Mineralists* of these

these last Ages. *England* and *France* being engag'd in a War, when first my my Book came forth; and all amicable Communication betwixt the two Nations suspended, 'twas not known there till the War was at an End. But, after that, it fell under the Cognizance of the Naturalists of *France*, from whom I have since receiv'd many Civilities: And in particular, from that great Mæcenas, *M. L. Abbe Bignon*, and some other learned Ecclesiasticks, particularly of the Order of the *Jesuits* there; from Dr. *Jussieu* the King's Botanick Professor, who oblig'd me with Samples of several *French* Fossils, with very intelligent Accounts of them: But there being no considerable Mines in that Country, the Curious there have not had much Opportunity of carrying on these Studies. Monsieur *Valkeneir*, residing for some Years at *Zurich* in Quality of *Envoy* of the *States-General*, having perused the *N. H. E.* and approv'd the Design, promoted it with great Constancy and Diligence, not only over the Country where he resided, but the greatest Part of *Europe*;

rope; and my Collection has been much enrich'd out of his Store. But the greatest and most beautiful Addition that ever was made to it, is owing to Signior *Agostino Scilla*, from *Rome*, he sending me not only all those noble *Fossils*, that he collected in *Sicily*, and publish'd in his *Lettera circa i corpi marini, petrificati* printed at *Naples* in 4^{to}, 1670; but likewise the *original Drawings* of each, done by his own masterly Hand. I might mention to you several others; but these will be sufficient to keep you in Countenance, and shew you that some, of the greatest Character in the whole learned World, have not disdain'd to embark in the same Bottom that you have done. As to those who have honour'd me and my Undertaking with their Patronage here in *England*, 'twould be too great a Task to recount all; and therefore I must not mention any; which will be the less Loss to you, as you are wholly a Stranger to them.

I am, &c.

Q

NUM.



NUMBER VI.

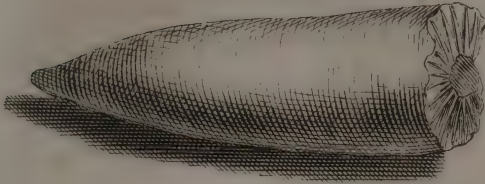
To the same.

*Of the Origin, Nature, and Constitution
of the Belemnites.*

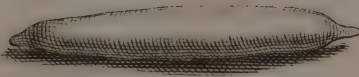
SIR,

AS to what you say of Mr. *Lbwyd*, he was much prejudic'd, and ready to catch at any Thing that might lessen the Authority of what I have deliver'd. I rank the *Belemnites* amongst the *native Fossils*, he would fain have it be thought to belong to the *Extraneous*: and his Book coming into every Body's Hands, some fell into his Notion; particularly Mr. *Butners* ^a, who examines little, and is very ready to fall in with any thing that comes in his Way. That is far from your Case; and tho' I have little Regard to them, I am so ambitious
of

^a *De Corall. Fossil. c. 6.*



1

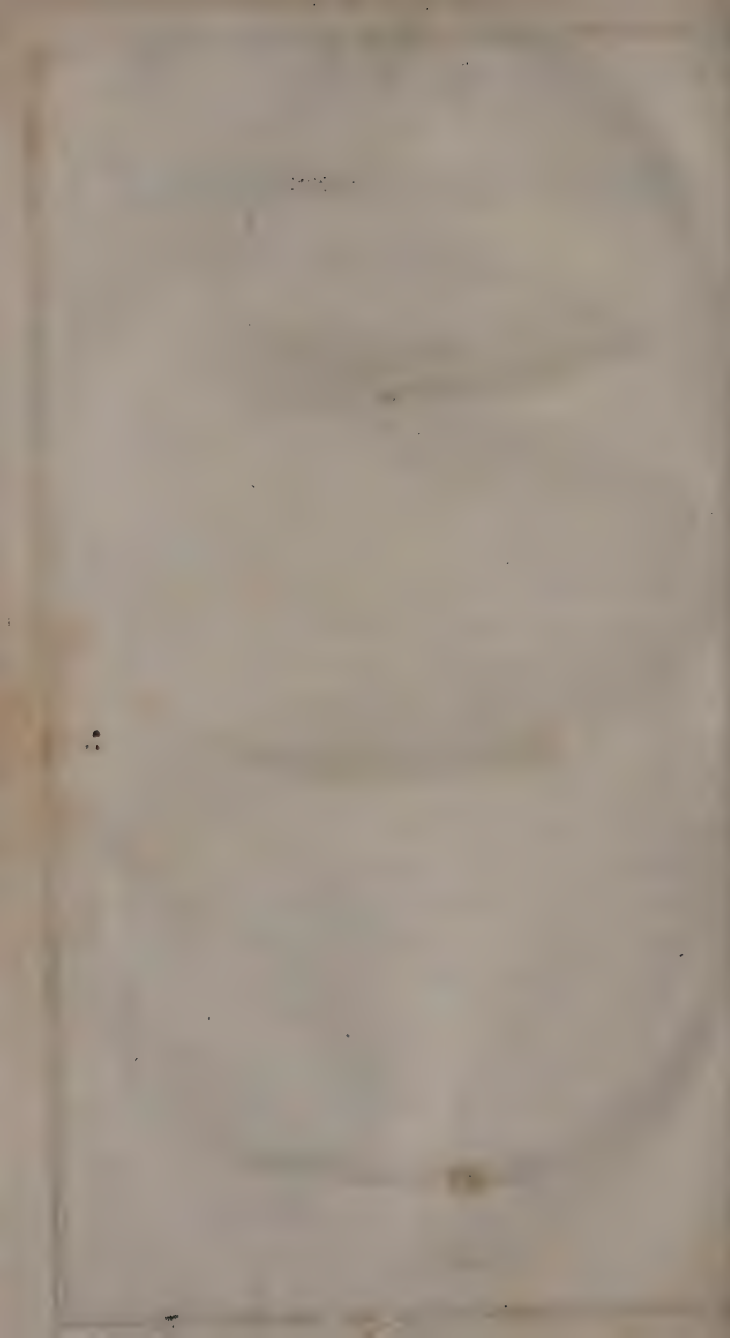


2



3

Part 2.



of the Opinion of a Man of your Weight, that I cannot contain my self, from considering what you write of the Subject. I grant indeed, as you observe, that *my Hypothesis is not at all concern'd of which Side soever the Question is determin'd, and will not in the least be affected, tho' the Belemnites be not, as I have asserted, a meer Stone.* But I am concern'd for the *Truth*, and have that Regard to you, that I would have you think I did not assert that, without sufficient Grounds; nor has any thing hitherto been offer'd, that invalidates my Assertion. Whenever any Thing does, you will find me very easy and ready to give it up.

Mr. *Lbwyd* ^b at sometimes fancies the *Belemnites* to be form'd in the *Pennicillæ Marinae*, at others, in the Shells, call'd *Dentalia*. Those are Bodies as different each from other as well can be, and both differ so much in Shape from the *Belemnites*, as to give little Umbrage

Q 2 *to*

^b *Lytrophil. Britan. p. 115. 121.*

to the Notion that it could be form'd in either. Besides, the Manner in which we commonly find the Belemnites, shews plainly it was not form'd in any Shell. When the Bodies so form'd are found lodg'd in the Strata of the Stone, tho' the Shells wherein they were originally form'd, be perish'd and gone, the Stones, moulded in them, are constantly surrourded with a Cavity, or a Space wherein the Shell lay, which Cavity ever answers to the Shape, and is commensurate to the Bulk of the Shell so perish'd. Now the Belemnitæ are ever found contiguous to the Mass of the Stone, without any such Cavity surrourding them. In this we have Evidence of Sense, and ocular Demonstration, that the Belemnitæ were not form'd in a Shell, or any external Mould. Had they had any such Mould, the Vestigia of it would have been easily enough discern'd, and the Cavity where the Shell lay presently discover'd. It must have been in some very large Shells. I have seen Belemnitæ near two Feet long, and above two Inches Diameter in the thickest Part. Shells in which such Bodies

Bodies could have been cast, or the Cavities wherein they lay, would be so big, thick and long, as to be descry'd without Difficulty.

I am the more forward to think, that the Reasons upon which you found your Suspicions, are not very firm and clear, because you are so unsteady in your Opinion. You formerly thought the Belemnites a Horn; now you fancy it a Tooth of some strange Fish, Bodies quite different in all Respects from each other. Your first Arguments for its having been an Horn, is, that it is in *Form of a Horn*, whereas indeed there are different Species of the Belemnites: And they differ very much in *Form* from each other. The three principal Species are, the *Conoid Belemnites*, which is the most common. The *Belemnites fusi-formis*, J. Bauhini, de Fonte Bollenfi, 4^{to}, and the *Belemnites Cylindricus in apicem utrinque desinens*. If those be all in *Form of Horns*, every Thing is in *Form of a Horn*. Your second Argument is, That 'tis lodg'd amongst Shells, Teeth, and other

other Animal Remains, found at Land, and in the Strata. In case this prove them Horns, it will prove Pyritæ, and many other mineral and metallic Bodies to be *Horns, or Animal Remains.* For these are found lodg'd amongst Shells, Teeth, and other animal Remains, full as frequently as the *Belemnitæ* are. Your third Argument is, That the Belemnites has a *horny Smell.* Now, if this be admitted, 'twill bring almost half the native Fossils into the Class of Horns, that *Smell* being common to *Stones,* and many other *Native Fossils,* that have in them Sulphurous or Bituminous Principles; and these they exert in greater Plenty, if rubb'd and heated. Indeed Stone, when first taken out of the Earth, emits very different Smells, *Ol. Worm.* mentions some that emitted a Smell like that of a Hog, which he therefore calls *Saxum Suillum*; other Stone, with the Smell of Violets, *Lapis Violaceo Odore.* They that are conversant with subterranean Things know, that not only Stones of
various,

various, but even of the very same Sort, emit very different Smells; so that no certain Judgment can be form'd from the Smell. Besides, I must acquaint you, that the *Belemnitæ* of *England* have rarely any Smell at all. They are found in great Numbers in Chalk, and I never could perceive a Smell in any of these. Those that you found attended with that Smell, had lain amongst Saline, Sulphurous or Bituminous Matter, that had imparted it to them. But what seems to me finally to determine this Controversy, and evince that the *Belemnites* is not a *Horn*, is, that *Horns* are very seldom found in the Earth. I have assign'd a plain Reason for that in the *Dissertation preliminary to my Natural History of the Earth*, I have shewn there, that *Horns, Hoofs, Teeth, Bones*, and other like *Animal Substances*, being lighter than the common Sea-Shells subsided last, and consequently being lodg'd near the Surface of the *Earth*, and there exposed to the Weather, and external Injuries, are generally perished and destroyed; few of them remaining at this Day. Whereas the *Belemnitæ*

lemnitæ are frequent, obvious, and occur almost every where. Nay, they are found to very *considerable Depths* in the *Earth*, which is owing to their specifick *Gravity*, much greater than that of *Horns* or *Teeth*, but equal to that of *Talky Bodies*, in which Class I have rang'd them. *That* their *greater specifick Gravity* furnishes us with another Proof, that they are not *Horns*, or *Teeth*. A further Argument of which is, That they differ greatly in *Texture, Constitution and Substance* from *Horns, Teeth*, or any other like Parts of Animals. But they agree very nearly with several Minerals. I have seen some that are Semi-diaphanous, yellowish, and somewhat resembling common Amber; which the Antients observing gave to both *Amber*, and the *Belemnites*, the same Name, *Lapis Lyncurius*; this Name importing that both were of an Hue yellowish, and like that of Amber; as are likewise several *Talcs, Spars*, and other Products of the Mineral Kingdom. Then, as to the *Constitution* of the *Belemnites*, if it be broke in any Manner, it is not tenacious and tough, as all Ani-

I

mal

mal Substances are: but *friable* and *brittle*, like *Talky* and such other Fossils. The Substance of it appears to be mineral even to the View; and this is confirm'd both by the Operation of chymical Menstrua, and every other Test. Its Texture is directly contrary to that of Teeth, and other hard Animal Substances, striated across; the Fibres diametrically intersecting the Axis of the Body; whereas the main Fibres of Teeth, Bones, Horns, Hoofs, Claws, Nails, and all hard Animal Substances run the quite contrary Way, and parallel to their Axis. But the striated or *fibrous Talc*, the *Gypsum Striatum*, *talky plated Spars*, the *Asbestos*, *Alumen plumosum*, the *septa* of the *Ludus Helmontii*, the *Pipes* of the *Lapis Syringoides*, the *Crusts* of the *Hæmatites*, and several other *Talky Minerals*, that might be recited, have their Fibres running in a transverse Manner, like those of the *Belemnites*. A remarkable Instance of this Texture we have likewise in some *Stalactitæ*, consisting of a *Talky Spar*, and found hanging down from the Tops of Grottos under Ground. There

R

are

are, in my Collection, several that are striated across.

THESE Things rightly consider'd, I hope I shall not be accus'd of Lightness, or Precipitation, in judging the *Belemnites* allyed to the Fossils of *Talky Constitution*, as I have done. It has nearly the same *specifick Gravity* that the *Talky Bodies* have, and is much heavier than Horns or *Teeth*. Then 'tis exactly of the same *Nature, Texture, and Constitution* that they are, and different in all those Respects from Horns, Bones, or *Teeth*. Nay, I am perswaded, the Arguments that I have offer'd, taken from the Shape of the *Belemnitæ*, are sufficient to satisfy any reasonable Man, and indeed amount to near a Demonstration, that they cannot have answer'd the Ends, nor serv'd for the Uses of *Teeth*, either to seize the Prey, or to chew it.

BUT, tho' it be certain, that the *Belemnitæ* have now none of them, any Thing of *Animal Substance* remaining, I allow it does not thence necessarily follow,

low, that they may not have been of Animal Origin; but 'tis very strange, they should *all of them* be thus chang'd; of which we have no Instance in any other Body whatsoever. 'Tis indeed not uncommon to find Shells of various Kinds quite chang'd, the Testaceous Substance dissolv'd, and a Mineral Substance substituted and repositied in the Room and Place of it. Nay, there are digg'd up, Parts of Trees so chang'd; and I have shewn^d how these Changes were brought about. But then, the Instances of these are very few in Comparison of the whole: And for one Shell that is thus chang'd, there are found hundreds that are not chang'd at all. Whereas the *Belemnitæ* are all changed, if any of them are.

WHAT I here offer, I intend as a Prelude and Introduction to what I am about to deliver in Answer to the Argument urged from the *Tubuli Vermiculares*, and small *Oyster-Shells* that are some-

R 2 times

^d *Answer to Camerar. Part 1. §. 6.*

times found adhering *externally* to the *Belemnites*. For, from this *Phænomenon*, some have hastily infer'd they are of marine Origin, and that these Shells were affix'd to them in the Sea before the Deluge. That will not by any Means follow from this; since there are *Flints*, *Pyritæ*, and other *native Fossils*, that were never existing in those Seas, that yet have Sea Shells adhering to the *Outsides* of them: And such I have in my Collection. For these, being stony and Mineral Nodules, among which I have ranked the *Belemnites*, were form'd during the Time that the Water was out upon the Earth^e: And the Matter which constitutes them, then concreted, and affix'd to these Shells.

BUT there may be a Test settled, whereby this Affair may be fully determin'd, and it may be ascertain'd, whether the Shell upon it, or the *Belemnites*, was form'd first. The Shells that affix themselves unto, and grow upon Rocks,
Stumps

* *Nat. Hist. Earth, Part iv.*

Stumps of Shrubs, and other fix'd Bodies, upon the Sea Shores, conform themselves in their Growth, so exactly to the Surface of the Body on which they grow, as to take the Form of it. Now, if those on the Surface of the *Belemnites* have done the same, and exhibit constantly the Lineaments of its Surface, then they were form'd since the *Belemnites*. But if this, in those Parts where it is contiguous to the Shell, be not, as it usually, and naturally is, smooth and plain, but exhibits the Lineaments, or any Impression of the Shell, then 'tis certain the *Belemnites* must have been form'd since the Shell: And much more, if there be Shells found included in the Substance, or incorporated with the Mass of the *Belemnites*. As, in all my Studies and Searches, I have nothing but the Truth in View, I willingly submit to this Test, for the Decision of this Affair, and to further Inquiry. For I have so seldom found *Belemnitæ* with *Shells* upon them, that I have not Observations enow of my own to determin it. There is but one in my Collection, that hath a few very small
Shells

Shells upon it; and I am unwilling to break it to make the Experiment.

THAT you may see I have not been without Thoughts of this Subject, near twenty Years ago, when I was drawing up my *Catalogue of the Fossils of England*, taking notice of these Shells affix'd to the Belemnites, I enter'd there a Suspicion grounded on this; with a Note for further Inquiry, *Whether the Belemnitæ may not have been originally Horns, or other like Animal Appendages, of which we see, by the Asteria, Eutrochi, and many more, there are, or have been, vast Numbers at the Bottom of the main Ocean, that never appear upon the Shores.* Nay, Sir! I will fling you in of Courtesy, another Note that I made at the same Time, (*Viz.*) “ The Belemnitæ sometimes appear to have been
 “ compress'd, crack'd, and destroy'd;
 “ which is what I do not remember ever
 “ once to have observ'd in any Fossil that
 “ was not form'd in an Animal Mould.
 “ But, in these, in Flints form'd in
 “ *Echini*, and some others, there are such
 “ In-

“ Instances; ” of which there are Accounts in the *second Part* of that *Catalogue*.

I am so ambitious and desirous, Sir! that you should have full Satisfaction, that I will proceed a little more particularly to examin the Notion, that the *Belemnitæ* have serv'd as *Teeth*. Now, of the many Hundreds that I have seen of these Bodies digg'd up here, and brought from Abroad, I never saw one that had the least Appearance of a *Fang* or *Root*, whereby it might be fix'd and detain'd in a *Jaw*. Whereas the *Teeth* of all Creatures that I have observ'd, as well those that are the Product of the Water, as of the Land, have all *Roots*, or some Signs of their having been connected to a *Jaw*. I know it will be said of the *Belemnitæ*, that the *Roots* are broke off, and lost. But 'tis strange, of so great Numbers as we find, there should not be the least Sign, or Remain of a *Root* on any. The Case is different in all other *Teeth*, as of *Sharks*, and other *Fishes*, and indeed all other Creatures digg'd up out of the Earth;

Earth ; these being commonly found with the *Roots* on, or, at least, with some *Remains* and *Signs* of *Roots*.

THEN, there is *one Kind* of *Belemnites* that is of such *Shape*, that I think it could not have serv'd for a *Tooth*, or even possibly have been fix'd in a *Jaw* ; I mean the *Belemnites fusi-formis* of *J. Bauhini*^f. This terminates in an *Apex*, or *Point*, at *one End* ; which, if any, must have been the *Tip*, or upper *Extremity* of the *Tooth*. But the Part of the *Body*, next this, is turn'd crass and thick ; and the other for at least half the *Length* of the *Body*, very slender and thin. Now, tho' this was the *Root*, of which yet there is not the least *Appearance*, it being of the very same *Constitution* with the rest of the *Body*, which the *Roots* of the *Teeth* of these *Fishes* that I have seen, never are : Or tho' there was, at the *Extremity* of this, a *Root* annex'd, and since broke off, the contrary of which may be demonstratèd meerly from *View* of

^f *De Fonte Bollenfi. Pag. —*

of several in my Collection, they being at this End so very small, that there was not Scope for Hold sufficient to connect or fix it to any Thing. I say, which Way soever it be suppos'd, intire, or broken, that Moiety of this Body, which must be imagin'd, if any, to have been next the Jaw, is so slender and small, that it is demonstrable it could be of no Use, and that the least Force would break it; especially if it be consider'd of how tender and brittle a Nature it is. Whereas the other Moiety of this Body is so tumid, thick and gross, that it could never be got to enter the Prey for taking of it, which these, if Teeth, must have serv'd for, without a very great Force, and such, as the other Moiety could never have Strength near sufficient to sustain, without being surely broke in the very first attempt. So that 'tis evident this Body could never have serv'd as a Tooth.

THE third Sort of *Belemnites* is very nearly of a *Cylindrick Form*, only terminating at each End in a *Point* or *Apex*,
S very

very ſhort, ſo as rarely to exceed $\frac{1}{5}$ of an Inch of Length. This is of the ſame Nature, Texture, and Conſtitution with the two precedent Kinds: And this I have found frequently *intire*; but I have never found any of the *Conic* that was ſo, tho', as has been intimated, they occur frequently, and in great Numbers; which I can hardly ſay of any Sort of Fossil beſides, either native or Extra-neous. For which Reason ſome have ſuſpected that the common or Conic Belemnites is broke in two about the Middle; and that it terminated originally, and while *intire*, like that above ſpecified, in a Point, at both Ends. Be that as it will, the Species that I am now treating of, has not the leaſt Appearance of its having had any Connexion with a Jaw. Nor indeed is a Body of ſuch a Shape, by any Means capable, either of being fix'd in a Jaw, or of taking of Prey, or of chewing of it. Indeed the *common Belemnites* is not much more capable of answering either of thoſe Uſes. It is generally ſo blunt at the End, as not to be capable eaſily to enter the Prey; and yet
not

not blunt or flat enough to masticate and chew it. Besides, both this, and the other two Kinds, are ever *streight*; whereas the *Dentes Apprehensores*, of all the *Fish of Prey* that I have ever seen, are, the better to fit them for taking the Prey, in some degree crooked. I wish my Deference to your Judgment, and the Zeal I have to give you full Satisfaction, have not drawn me on so far, as, instead of that, by this Time to have given you Pain, and tired out your Patience. *That* I must leave to your Goodness; but, for fear of the worst, I will defer my Returns to what you are pleas'd to command in Relation to the *Coraloids*, or *Coralls digg'd up at Land*, to some other Opportunity.

I am,

always with great Regard,

Sir, &c.



NUMBER VII.

*Of the Coralloids digg'd up at Land;
the Nature and Origin of them.*

SIR,

WHILE there are so many forward to write, and think themselves qualify'd for that Purpose, so soon almost as they turn their Thoughts to any Subject, and without, first, being at the Trouble of duly apprising themselves of it, or of what others have deliver'd concerning it, the Minds of their Readers must be in a perpetual Maze, and Truth upon a lubricous and very unsteady Foundation. The more so, as there are some, who, tho' really much better Judges than the Authors they read, without Suspicion, or due Examination, fall into their Sentiments, and adopt their Notions. 'Twas this Way, Sir! that I am persuaded you fell into yours, of the Origin of the Coralloids, as one or two other very
 excel-

excellent Men have done, I mean, on Perusal of Dr. *Buttners Corallographia Subterranea*. That Author follows me, tho' he be not pleas'd to refer to my Book, in most other Things; and thinks, so far as he is wont, he does so even in this; failing on in a full Gale of Fancy, and judging of Things pell-mell, he stumbles, thro' meer Inadvertency, into the Notion, that the *Fossil Coralloids* are of *Antediluvian Origin*; and were by the Deluge brought out of the *Sea*, along with the Shells, and other *Animal Substances*, to Land. Indeed, that he may proceed in Form, and the more like an Author, he brings in what he is pleas'd to call *Arguments*, in Support of this. But, being on no very high Guard, unluckily they either prove nothing at all; or else the quite contrary of what he alledges them for: His first method of arguing is from *Similitude*; and comparing the *Fossil Coralls* with the *Marine*. He avers both have what he calls a *Basis* or *Root*. That is commonly true of the *Marine*; but of the *Fossil Coralls*, he gives not so much as one single Example that is clear and
plain;

plain; nor of the Multitudes that I have seen, have I ever met with one. His second Argument is, that *both* have been *once* soft, or in a State of *Solution*. That I have prov'd very fully; but it makes nothing for his Purpose; the Question is not about the *Fact*, but the *Time*. No Body doubts, but that they were *soft* at the *Time* of their *Formation*; all Things in Nature whatever, are so; but that *Time* was not, as he presumes, *before*, but *during* the *Deluge*. He proceeds in his Way of comparing the *Marine* with the *Fossil Coralls*. Some of those, he says, have a Tendency to a *Vegetable Form*, they have *Trunks, Knots, Branches*; so likewise have these: Others of them have *Pores, Stars*, and other Accidents, wherein they agree with these. But then he knocks down all again, and comes over to me, when he avers, that the *Coralls found at Land*, are of a real *stony Nature*, and chiefly of *Flint*. If this be so, they are as different as well can be from those *found at Sea*. He never saw one of those of *Flint*. However that be, he is peremptory as to the
Fossil

Fossil Coralls: And goes on to assert, That *Flint is nothing else but an Antediluvian Corall.* Cap. vi. §. 2. Now *Flint*, or *Chert* is found in Form of *Strata*, as well as in *Nodules* of all Forms, of which some few are jagg'd and uneven, which are what I suppose he calls *branch'd*. So that if *Flints* are *Coralls* brought out of the Sea, *Free-Stone*, *Marble*, and, to be short, every Thing else that is either in Form of *Strata*, or *branch'd*, must, by this Way of Reasoning, be brought thence too. His next Argument is, That the *Fossil Coralls* are found lodg'd in the *Strata* along with *Shells*, and other *Productions of the Sea*. The Fact indeed is so; and it has been observ'd a thousand Times, that there is in the *Strata* such a Confusion of Things of the most different Nature, and Origin, Animal, Vegetable and Mineral; but whoever made an Inference like this from it before? There are found lodg'd in the *Strata* with *Shells*, *Nodules* of all Kinds, *Stony*, *Mineral*, *Metallic*; does it follow that these were brought from Sea, because the *Shells* were? If it do, all Bodies what-
ever

ever were brought out of the Sea. Dr. *Buttners* rejects *Chymical Trials* of the *Coralloids*, Cap. 6. §. 17. except in one Case, which makes for his Purpose, where he alledges in Proof, that *Flints* are *Coralls*, because they will calcine as well as these. Cap. vi. §. 8. which, that I may note that by the by, brings Stones, and all other Bodies that may be calcin'd, into the Class of *Coralls*. In fine, his only grand, and, as he thinks, *infallible Argument*, is founded wholly on their exterior *Form*, and *Structure*; *tantum ex structurâ Coralliorum marinarum, tanquam notis echaracteristicis certissimis nostra judicemus Fossilia*. Cap. v. §. xvii. He neither cares to admit *Chymical Trials*, nor bring both to the Test of their *specific Gravity*, nor indeed any other, whereby Judgment may be form'd, of their *interior Constitution*, *Substance*, and the *Matter* of which each are compos'd; tho' that be the only sure Way to shew the *true Nature* and *Origin* of both. To that therefore I shall have Recourse: Of the Multitudes that I have observ'd, I never light of so much as one single Fossil

Fossil Coralloid that agreed with the Marine, or was of the same *Substance* and *Constitution*. How greatly they differ from the Marine, and indeed from each other in *Substance*, may appear from the following Instances. Many of them consists wholly of a *Sparry* Matter. Others of *Crystall*, sometimes very near clear and pellucid. Some of them have their constituent Matter of Flint, others of Agat. Others of Vitriolic, and the like Salts, that ordinarily in Tract of Time moulder, liquate, and fall to Pieces, after the Manner of the Vitriolic, and other Salts in the common Pyritæ. I have seen *Fossil Coralloids* that have been compos'd of various Sorts of Mineral and Metallic Matter, that yet have been form'd into Shape of the *Marine Mycetitæ*, *Astroïtæ*, and other like *Coralls*. Now all these have been form'd out of the dissolv'd Mineral, and Metallic Matter in the Water of the Deluge^a. The Antediluvian Coralls were like all other solid stony Bodies then in Solution in that Water;

T and

^a *Nat Hist. Earth. Part. iv.*

and might concrete again, and form true Coralls, there, as well as in the Sea-Water. Doubtless it did so; but that Matter was in so small a Quantity, and bore so little a Proportion to the Mineral and Metallic, with which it was then mix'd and confus'd, as now rarely, if ever, to be met with. I never found one Sample compos'd of it, pure and distinct. Which cannot be thought strange, if the Antediluvian Coralls were all dissolv'd and destroy'd. Whereas, if they had been preserv'd, and, as Dr. *Buttners* supposes, brought, along with the Shells, to Land, they must have been now found commonly there, as well as the Shells. They would be full as easy, or indeed more easy to be discover'd, than the Shells; not only as they must have been in great *Numbers*, but very many of them are of *Colours* that soonest strike the Eye, and are the most easily discern'd. Such are the *Fistularia purpurea* of *Ferrante Imperato*, and the *Red-Corall*; of both which there are such vast Quantities found in several *Seas*, particularly in the *Mediterranean*, on the Coasts of
Spain,

Spain, Italy, and Sicily. Then, many Kinds of the *Marine Coralls* are very *large*, so that, had they been brought forth, and left at Land, they must have been obvious, and very easily found out. I need go no further for proof of this, than to the *Astroites Maritimus Coralloides undulatus major*, or, as 'tis commonly call'd, the *Brain-Stone*. This is found in great Numbers, in *several Seas*: And I have seen of all Sizes, to twice, nay, thrice the *Bigness* of an *Ox's Head*. Surely such Bodies as these, were there any, could not be hard to spy out.

UPON the whole, I think 'tis very evident, that there are few, if any, *true Sea Coralls*, ever found at Land. Consequently those that we do actually find were not brought from Sea: And Dr. *Buttners* is led into his Error, by taking a meer *Cloud for Juno*, Bodies that had only some slight *exterior Resemblance* of Coralls, but nothing of their *Substance* or *Constitution*, for real Coralls. When the *Spaniards* first took

Possession of *Mexico*, amongst other Things new and surprizing, they found in the Gardens of the *Americans*, plac'd for Ornament, in a very elegant and beautiful Manner, *Artificial Flowers*, which they had made of *Gold*, so nearly approaching, in exterior Form and Shape, the true, as to cause much Admiration in the *Spaniards*; as near indeed, or perhaps nearer than the Fossil Coralloids do the Marine Coralls. But yet I have not heard, that any of the *Spanish Philosophers* fell into the Speculation that these fine *Gold Flowers* were brought forth of *Seeds*, as the natural were. Tho' had these Gentlemen done so, they had full as much, and indeed the very same Reason of their Side, that Dr. *Buttners* had; and he might justly have claim'd the Honour of being added to this *Hispano-American Sect*. As things now stand, I'm as much puzzled to find out, in what *Sect* of *Philosophers* to range a Gentleman so anomalous as he is, in what Class of Fossils to range the *Belemnites*.

I wish,

I wish, Sir! that I have not, by this Time over-convinc'd you, and brought you to your *Obe! jam satis est, Obe!* Tho' it be so, that I have, I ought to make no Apology: You have put me upon a Sort of Force. If the *Belemnites* should, tho' I see no likelihood of that, prove not to be a native Fossil, no more is needful than to change its Rank. You own your self it affects not the Whole. But, as to the *Coralls*, in case those now digg'd up be the *Antediluvian*, they are a lasting and standing Monument and Evidence, that there interven'd no *Dissolution*; or, at least, that it was not *universal*. For, if one Set of Bodies, really stony, could so maintain their *Solidity*, and secure themselves against the common Law then in Force, so as to continue intire and *undissolv'd*, why might not any, or all the other Setts do so too? You must not therefore blame me. You see the Question is of the utmost importance: And you have made it necessary for me to give you all this Trouble to defend it, and shew you, that

86 *Letters relating to*

that these *now digg'd up*, are *not real Coralls*, but of very *different Nature*; which I hope I have done to your Satisfaction, and shall rejoice to hear that.

I am, Sir, &c.



NUMBER VIII.

Concerning Coralls, Corallin, and other like Bodies form'd at Sea.

PREFACE.

THO' these elegant, beautiful, and very extraordinary Bodies, have been much admired in all Ages; yet, lying far out of the Way, being hard to come at, and their Growth under Water, where accurate Observations cannot well and easily be made, 'twill not be thought strange, that our Accounts of them are mighty defective, and that little Progress has been hitherto made in the Natural History, and the Process us'd in the Pro-

Production of them. 'Twas this which first drew my Thoughts to the Study and Consideration of them. But when afterwards I found at Land, and in the Bowels of the Earth, various Bodies carrying some exterior Resemblance of the Marine, it engag'd me to allow them some further Consideration, and carefully to compare both together. In order to this, the Coasts of England yielding very few Coralls, I had Recourse to my Friends in Foreign Parts, where these Bodies are found in greater Plenty and Variety; and by their generous Contributions, my Collection has been so far increas'd, as to exhibit Phænomena sufficient to point forth the Process of Nature in the Formation of these Bodies. Of this I have prefix'd some Account to the Catalogue of the Coralloids digg'd up in England. The following Directions were drawn up at the Request of Sir Hen. Newton, then Envoy of Great Britain in Tuscany, on the Coasts of which Country these Bodies are more frequent.



Num. 9

DIRECTIONS

For making Observations on Coralls, Corallin, and other like Bodies.

I. **G**ET an Account of the several Places in which Corall is found.

II. **A**LSO of the various Kinds of Corall found in each Place: Their various Shapes and Colours.

III. **A**ND of the Manner and Posture in which the Corallin Bodies, particularly the Shrubs, grow; whether erect, horizontal, or hanging down like Iceicles from Jetts of Rocks.

IV. **A**T what Depth the Corall grows. And whether only in Parts of the Sea that

that are under Shelter, and quiet, as in Creeks and Bays; or in those that are more exposed and disturbed, as off Promontories, and the like: Or in both indifferently.

V. OF the Colour, Nature, and Constitution of the Rocks and Cliffs, upon, or near which the Corall grows. Particularly observe, whether there be any Red Stone, or other terrestrial Matter that is Red, near those Parts where the Red Corall grows.

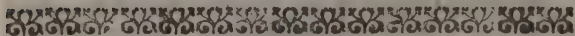
VI. WHAT is the Sense and Opinion of the *Pescadori*, or Corall-Fishers, and of other more intelligent and curious Observers of the Growth and Formation of Corall; of the Matter whereof it is formed: And of the Place from which that Matter is deriv'd.

VII. TO what other Bodies is Corall found growing besides Rocks, loose Stones, Pebles, Flints, and Shells.

VIII. Is there any Way of making Judgment, whether the Corallin Bodies grow quickly or slowly: And in what Space of Time they are formed.

IX. Are the Corallin Bodies ever found broken and beat off the Rocks by the Agitation and Motion of the Sea in Storms.

X. WHAT are those Creatures that the Corall-Fishers call Worms, that scoop, bore, and hollow the Coralls.



DIRECTIONS for making Collections of Corall, Corallin, and other like Bodies.

I. SEND Samples of Corallin Bodies of all Sorts, all Sizes, Shapes and Colours.

II. ALSO

II. ALSO of those which are various; several Sorts, or Corallin Bodies of several Colours, growing together.

III. AND Samples shewing the Manner of the Growth of the Corallin Bodies, upon Stones, Shells, or any other Things.

IV. LIKEWISE of all Bodies whatever, that are drawn up by the Corall Fishers; not only the Corallin Shrubs, Red, White and Black; but of the *Corallo Stellato*, *Articolato*, *Hippuris Saxea Pori*, *Millepora*, *Retepora*, *Frondepora*, *Madrepora*, *Tubularia*, [mention'd by *Ferrante Imperato*, *Historia Naturale*. L. 27.] *Fungi Marini*, [mention'd by *Padre Boccone* in his *Observation. Nat.* 12°. his *Museo di Fisica*, 4°. and his *Recherches and Observ. Naturalles* 8°.] *Brain-Stones*, *Astroitæ*, and all others: And even of the Corallins, Sea Fans, Halcyoniums, Sponges, Mosses, Algas, or Fucus's, Sea Shrubs, and Sea Weeds, of all Kinds: As also of the Shells, and

Stones of all Sorts. In a Word, Samples of all Bodies whatever, that are dragg'd up in the Corall Fishings: And particularly of all those Bodies that the *Pescadori* call *Ravano*.

V. SEND Samples of the Rocks in the Neighbourhood of the Corall-Fishings; and of any other terrestrial Matter, out of which the Corall may be imagined to be formed.





THE

PREFACE.

THOSE who travel and pass suddenly from Place to Place, have less Opportunity of informing themselves of all Circumstances of Things, than they that dwell, and are constantly upon the Spot. For which Reason, wherever I found, that either the Proprietor himself, some other Gentleman that happen'd to live near, or the Steward and Overseer of the Mines, had Curiosity and good Disposition, I engag'd them to make Observations and Collections; leaving with them Directions for the Purpose. By this Means I receiv'd some Additions; but not to near the Number that, were Gentlemen better apprized of the Uses of these Things than they commonly are, I might have reasonably expected.

The PREFACE.

Partly therefore on this Account, and partly because my Affairs call'd me up to London, before I had compleated what I first design'd, and visited all the Mines that I intended, I concluded to send Persons on Purpose to all Parts where I wanted further Satisfaction and Intelligence; which I did at my own private Expense.

Of these, the first that I imployed thus was Mr. Thomas Lower, my Servant, a young Man, related to Dr. Lower, and of a good Family in Cornwall. Thither I dispatch'd him with Directions to make Observations in the Tin Mines, and to collect all the Ores and other Minerals he could procure. Being a sensible Man, and very careful, he executed his Commission with that Success, that he not only made for me a large Collection of Samples, well chosen, but a great Number of pertinent Observations of the Water in the Mines, and the Condition of Things there very much to my Purpose.

This encourag'd me to proceed, and send others on the same Design; which I did,

The PREFACE.

did, but none to better Purpose than Mr. John Groom, and Mr. Richard Meales, two learned and ingenious Gentlemen, who were pleas'd to travel over a great Part of England for me, and particularly all the northern Countries.

'Twas for the Service and Conduct of these Gentlemen, that the following Directions and Queries were drawn up. Those relating to the Oeconomy of the great Abyss, Steams and Damps in Mines, Fogs and Mists on great Mountains, and to Meteors, were added by Command of the Lord Bishop of Man, and Sir George Wheler, two Persons not more illustrious for their Piety, Virtue, and Knowledge in their own Profession, Theology, than their Insight into all other good and useful Learning. Residing in Parts where they had great Opportunities of making these Observations, they were the more capable of promoting my Design; and indeed I am oblig'd in Gratitude to acknowledge they were two of the most generous Benefactors to it.



BRIEF DIRECTIONS

For making

Observations and Collections,

A N D

For composing a travelling Register of all
Sorts of F O S S I L S.

I. *Of keeping a Register of the Fossils as they are Collected.*



Y Means of Paste, Starch, or some fit Gum ought to be fix'd on each Sample collected, a bit of Paper, with a *Number upon* it, beginning with N^o. 1. and proceeding to 2, 3, and so on, in a continual arithmetical Series. Then, in the Register, enter *Numbers*, answering those fix'd on the
the

Fossils, and under each Note, 1°. *what Sort* of Fossil or Mineral 'tis reputed to be. 2. Where 'twas found. 3. Whether there were more of the same, and in what *Number* or *Quantity*. 4. Whether it was found on the *Surface* of the Earth: 5. Or, if it lay deeper, note at what *Depth*. 6. In what *Posture* or *Manner* it lay. 7. *Amongst what* Sort of terrestrial Matter 'twas lodged: 8. Whether in a Stratum, or perpendicular Fissure.

II. *Of Searches upon the Surface of the Earth.*

WHERE the Ground is covered with a *Turf* and *Herbage*, few Minerals are to be met with ordinarily, unless in such places as have been formerly ploughed. But where the Earth is disturbed and turned up by *plowing*, *digging*, or any other Means, there Minerals are frequently brought forth, and exposed to Light; so that *ploughed Fields* ought not to be neglected; especially those that lye *high*, and are *raised* above the neighbouring Plains and Valleys; for in such the loose Mould
is

is wash'd off by Rains, born down, and by that Means such observable Fossils of all Kinds, as lay within, near the Surface, are laid bare and uncovered.

BUT the Tops and Sides of *Hills* and *Rocks*, the Earth and Sand being perpetually worn and beaten down by Showers and Storms, never fail of a *more plentiful Shew* of these Bodies, and a fuller Gratification of the Curiosity of an Enquirer.

THEN, for the *Shores* of *Rivers*, and of the *Sea*, and the *Cliffs* adjacent, these usually afford Variety of Minerals, and other observable Bodies; the Water washing and bearing off the Earth in which they were originally lodged, by that Means exposing them to View. 'Tis here we find great Numbers of Pyritæ, and other Mineral Nodules: Nay, oftentimes Jett, Amber, Agates, and Stones of much greater Worth: As also Shells, Teeth, and other like Things that came first forth of the *Cliffs* and neighbouring Earth.

Earth in which they had lain ever since the Deluge.

BUT the Bowels, and *deeper Parts* of the Earth, contain the greatest Number and Variety of these Bodies. And, for Discovery of them, Recourse must be had to such Places where there is sinking for *Metalls, Marble, Stone, Alabaster, Coal, Gravel, Chalk, Oker, Fullers-Earth, Clay* for Pots, Tyles or Bricks, *Sand, Marle*, or the like: Or when there are Wells making: And in short, wherever there is *Digging* upon any Occasion whatever.

III. *The Method of making Observations in Mines, Pits, and Quarries, and of compiling a Register of them.*

I. THE first Thing to be taken notice of is the Place and Site of the Mine, Pit, or Quarry, whether it be in a *Valley*, on a *Plain*, or on an *Hill*.

II. WHETHER the *Descent* into it be perpendicular, and by a downright *Shaff*,
or

or the Passage down be only upon a shelving or inclining Way.

III. Note the *Extent* of the *Aperture* of the Quarry Pit or Mine ; as also of the several *Vaults* in it, and how far the *Strata* or Beds of Stone, Earth, &c. are *extended* and exposed to View in Front.

IV. Then proceed to consider the several *Strata*, remarking, 1°. how they *terminate*, or whether they be distinguished from each other only by the *different Nature*, Colour and Consistence of the Matter that constitutes them ; or are severed by Joints, Partings, or *Fissures* running betwixt them. 2°. In what *Posture* the *Strata* lye, whether level and horizontal, or *inclining*. If the later, note to what Point of the Compass the Dipping or *Inclination* bears, and how many Inches or Feet the *Stratum* sinks below the Level, or horizontal Plane, in some certain determinate Space ; as suppose in the Course of 4, 6, or 8 Yards. 3°. Whether all the *Strata* lye *parallel*, and conformable to *each other*, and to the exterior *Surface* of

the *Earth*. 4°. After this, come to a closer Examination of each single Stratum apart, beginning at the *Top*, and taking them one by one in Order as they lye, quite down to the *Bottom* of all; noting every Particular observable Circumstance in each; e. gr. the *Thickness* of the Stratum, and whether it be of equal Thickness in all Parts of it. The Thickness of the several Strata, added together at last, give the *whole Depth* of the Mine, Pit, or Quarry. Or if these cannot conveniently be measured singly, the whole Depth may be taken; the *Consistence* and Constitution of the Matter or Bodies that compose the Stratum, 1. Whether it be loose and soft, or hard and solid; or partly loose and partly solid; what particular *Sorts of Matter* each Stratum is composed of, e. gr. Marble, Alabaster, Free-Stone, Lime-Stone, or any other Sort of Stone; or Coal, Ochre, Chalk, Sand, Gravel, Clay, Marle, or of Metallick or Mineral Matter: What other *Sorts of Fossils* are embodied in, or lodged amongst the ordinary Matter of the Stratum; e. gr. *Stones of an observable Figure*, as the Belemnites, Selenites,
Myce-

Mycetites, Corallites, Astroites, &c. or any *Mineral Nodules*, such as the Pyrites, Marcasite, Hæmatites, Manganese, Jett, Amber, Agate, Cornelian, Flints, Pebles; or *Metallick Nodules*, or Lumps, yielding Copper, Iron, Tin, Lead; or any *Metallick or Mineral Matter* interspersed in *small Parts*, and mixed with the Sand, Stone, Earth, or other common Matter of the Stratum; examining whether the said Metallick and Mineral Nodules, or Matter, be chiefly of *one Sort*; or, if of *several*, what *Proportion* there is of each. Observe whether there be any *Trees*, Nuts, Acorns, Fir-Cones, Leaves, or other *vegetable Bodies* lying in the said Strata; or any *Teeth*, *Bones*, *Horns*, *Hoofs*, or other *Parts of Animals* of any Sort; or *Shells* of the *Crustaceous Kind*, e. gr. Crabs, Lobsters, &c. or of the *testaceous*, such as Oysters, Muscles, Scallops, Lympets, Perewinkles, or any others whatever. But with more particular Care examin the *Strata that lye deepest*, and at or near the *Bottoms* of Pits, Mines, and Quarries, to discover whether they contain any *Shells*, or other like extra-

neous Bodies. If the said deeper Strata be of *Stone* or *Marble*, break off Pieces, and *wet* them with *Water*, to wash off the Dust or Powder that may cover and obscure them; then viewing them with great Application, observe whether broken Edges or other Parts of Shells do not appear. The Shells, and other extraneous Bodies immers'd in Stone, have oftentimes their Pores so saturated with the same Sort of Sand with that which constitutes the Stone; nay, even their Surfaces are so ting'd, and frequently so much of the same Complexion with the Stone, that they are not to be discovered without a very nice and careful Examination. Lastly, Note in what *Numbers* the said *Vegetable and Animal Bodies* are found; in what *Posture* they lye, and particularly, whether the *flatter* and broader *Shells* (as likewise the flat and compress'd *Mineral Bodies* of all Sorts) be not repositied in such Manner, that their *Flatts* are parallel, and conformable to the Surface of the Stratum in which they are enclosed. Enquire whether there are latent in the said Strata,
any

any Flints, Pebles, or other Bodies that resemble, or have Marks or Impressions of Shells, or of Leaves, Teeth, Bones, &c. upon them.

V. Observe whether each single Stratum of Stone, Marble, or other solid Matter be *whole* and *continuous*, or *broken* and divided by Clefs or *Fissures*. In case they are, take notice, 1°. whether the said Fissures sever, and pass down thorow only *one*, or *more*, or all the Strata. 2°. Whether they be *perpendicular*, and tend upwards directly towards the Surface of the Earth, or Slant and decline, 3°. Of what *Wideness* and Capacity they are. 4°. In what *Number*, and at what *Distance* from each other. 5°. Whether the Strata, on one Side the Fissure, *answer*, tally, and fit those on the opposite Side of it.

VI. EXAMIN whether those *Fissures* be *empty*, or contain any *Matter* in them. If the later, observe, 1°. of *what Sort* it is, whether some Kind of *Ore*, e. gr. of Lead, Tin, Iron, Copper, &c. or some

Mi-

Mineral, as Sulphur, Mundick, Marcasite, Calamin, Amianthus, Cobalt, Loadstone, Cinnabar, Antimony, Bismuth, Speltre, or Talc, Spar, Crystall, or whether there be Amethyfts, Topazes, Saphires, Emeralds, &c. or common Salt, Nitre, Vitriol, Alum, &c. 2°. In what *Number* or *Quantity* the said Ores, Minerals, and other Things are found. 3° In what *Order* they are repositid in the Fiffures. 4°. In what *Manner* and *Form* they appear; whether they lye only in *rude Masses*, or are disposed and shot into any *observable Figures*, e. gr. Rhombs, Cubes, Pyramids, &c. Whether the *Native Metals* be ever found in Threads or Plates or Masses, so *pure* and free from Admixture of other Matter, as to be flexible or *malleable*. And whether any Part of the Metallick or Mineral Matter be formed into *Stalactitæ*, or Bodies resembling *Icicles* hanging down from the Jetts of the Fiffures, or vaulted Tops of Grottoes; or cover and *crust* over the Stone at the Bottoms and Sides of them.

VII. OBSERVE in *what Manner Water* issues into Pits, Mines, and Quarries; in what Quantity it enters; at what Time it is most plentiful; whether it be *pure* and tasteless, or *tinctured* with Salt, Nitre, Alum, Vitriol, or some Kind of Mineral.

VIII. ENQUIRE, whether any Gusts of *Wind* be ever observed in the said Pits or Mines, or any Sorts of *Damps*, or *Steams*; what are the *Signs* or presages, and what the *Consequences* and *Effects* of them; at what *Seasons*, and in what Sort of *Weather* they are chiefly observed; what *Temperature* the Air bears, as to *Heat and Cold*, in Pits or Mines; and whether it be constant or changeable; in case the later, Information should be got at what *Seasons*, and upon what *Occasions* those Changes happen; as also, whether there ever be observed any *Steams*, *Damps*, unusual *Heat* or *Cold*, or any other remarkable Accident in the *Bottoms* of Mines, Pits, or Quarries, a little before, or during the Time of *Rain*,
Hail,

Hail, Wind, Storms, Thunder, or other extraordinary *Weather* in the Air above. [See the Appendix infra.]

THIS is the fittest Conduct and Procedure I can pitch upon for their Observations and Enquiries; and what Intelligence and Information is gain'd by them may be enter'd into the *Register* in the very *Method* it must needs arise by the Regulation of the Course of the Observations according to the foregoing Directions, or as near as conveniently may be. To which Purpose that Register ought always to be *ready* at Hand on these Occasions; and the Observations entred upon the *Place*, for fear of Mistakes, or Failure of Memory. At least, *Notes* ought to be taken upon the Spot, and they to be entered into the Register as *soon* as may be, and while all is fresh in Mind. In the transacting of this whole Matter, great *Truth* and *Faithfulness*, as well as *Exactness* and *Care*, ought to be used; a Failure in either, tho' very small, leading oftentimes into considerable Errors.

THE Instances here pointed forth, and the Phænomena to be observed, are very *numerous*; and 'tis not to be expected, that near so many can ever occur in *any one Pit* or Mine. Or if they do, there are few Persons that have the *Leisure*, or perhaps the *Curiosity* to attend to all of them. In which Case 'tis only desired that those *Instances* that do occur in any Place, whether they be more or fewer, be noted; and such *observable Bodies*, as appear, be collected. And for those who cannot bestow much, may at least employ some Time in these Searches; which, if they do, and are but Masters of *Judgment* and *Thought* enough to make the Use of them, that they may easily do, they can never have Cause to think that Time mispent. For *these Inquiries* tend not only to the promoting of *secular Profit* and *Advantage*: But, which is not less considerable, carry the *Mind* of Man into a Field of *Knowledge* that is extensive, entertaining, and instructive, hardly to be express'd by Words.

Y

BUT

BUT there are some of the Observations that cannot well be made by any but the very *Persons employ'd* in *Digging* and *Mining*. The *Adits* and *Shafts* of Mines are usually fenced and *covered* with Timber to secure the Earth from falling in; so that the Strata of those Shafts by that Means being concealed and screen'd from View, an Account of them can be had only from the *Miners*, and those who sunk them. But then the Strata at the *Bottom* of those Mines lye fair and open for Observation, and may be viewed oftentimes to a very great *Extent*. Again, there are other Things that require *Time*, and some considerable *Abode* in the Mines, Pits, or Quarries, to come to due Knowledge and Information of them. Such are *Winds*, *Damps*, and *Exhalations* in the Bowels of the Earth; the *Vicissitudes* and *Seasons* of them; the various *Temperature*, Heat and Cold of the Air underground, at *different Times*, and the like. These must be learned of the *Miners* and *Workmen*; and they may be likewise conferr'd

with

Y

with

with about those Things that are *more obvious*, and liable to Observation. But particular *Care* ought to be had not to consult or take Relations from any but those who appear to have been both *long conversant* in these *Affairs*, and likewise Persons of *Sobriety*, Faithfulness and *Discretion*, to avoid the being misled and imposed upon either by *Falshood*, or the Ignorance, *Credulity*, and *Fancifulness*, that some of these People are but too obnoxious unto. And, after all, there ought to be a *Distinction* made in the Register betwixt those Observations *personally* made, and those that are *communicated* by the *Miners*.

APPENDIX I.

Concerning Mines.

ENQUIRE of the Miners, 1°. Whether they have ever met with any Evidences of the *Growth* of any Metall or Mineral; and whether after a Stratum, Vein or Fissure, is once cleared, and the

Ore intirely taken forth, they ever after find any, either of the same, or any other Sort, in that very Stratum or Vein.

II. WHAT *Signs* in the Earth or Water, the Miners conduct themselves by in their Working and Searches after latent Metalls and Minerals.

III. WHETHER there be any Thing particular and observable in the *Instruments*, or in the *Methods* they make use of in *mining*.

IV. WHETHER they use any Sort of *Flux* in their *smelting Works*, besides *Slagg* or *Cinders*; or there be any Thing uncommon, and peculiar in the *Structure* and *Contrivance* of those *Works*.

V. WHETHER there be any particular and extraordinary mechanical *Instruments* or *Artifices* made use of in their *Forges* or *Furnaces*.

VI. WHETHER the Persons that frequent and work in the Mines be sensibly injured

injured in their *Health*, by poisonous or unwholsome Steams arising thence: Or the Air, Water, Herbs, or Fruits near the Furnaces or Forges, be *noxious* or offensive to Men or Cattle.

APPENDIX. II.

Relating to such Fens, Boggs, or Marshes, in which the Peats or Turffs used for Fuel are got.

1. OBSERVE their *Place* and *Site*, whether in a Valley, on a Plain, or an Hill.

2. THE *Bounds* and *Extent* of them; and whether there be not Tracts of *Sand* or *Earth* of a Nature different from that of the *Turff-Earth* interposed amidst it.

3. EXAMIN what is the *Thickness* of the Stratum of the *Turff-Earth*; and whether it be of the same *Thickness* in all Parts of it.

4. WHAT

4. WHAT *Sort of Earth*, Sand, or other Matter lies at the *Bottom* underneath the Turff-Earth,

5. WHAT are the Properties, *Nature* and Constitution of this Earth; and whether it be all of the same, or of different *Sorts*.

6. ENQUIRE whether the Turff-Earth grow; or, what Evidences there are, that when it, or any Part of it, is cut and digg'd up, 'tis in Tract of Time repair'd and supply'd afresh.

7. WHAT *Springs*, or other Receptacles of Water there are in these Marshes.

8. WHETHER there be any Bones, Teeth, Shells, or other *Animal Substances* found lodged in this Earth; and at what *Depth*, in what *Manner*, and in what *Numbers* they are found.

9. WHE-

9. WHETHER any Trees, Shrubs, Herbs; Fir-Cones, Nuts, Acorns, or any other *vegetable Bodies*. Of what *Kinds* they are, and whether there be of the same *Kinds* of Trees, Shrubs, &c. *now growing* in or near those Marshes; at what *Depth* they are found, of what *Bigness*, and in what *Numbers*. In what *Posture* the Trees lye, in what *Condition* they are found as to *Firmness* and *Soundness*: Whether the *Roots* be found yet adhering to the *Stump* of the Tree, the *Trunk* or *Body* being sever'd off from it: Whether, if so found, the *Stump* be in a *growing Posture*, standing up above the *Roots*, or it be also sometimes *reversed*, and turned topsy turvy, with the *Stump downwards*, and under the *Roots*: Whether *one Stump* with the *Roots* be not sometimes found placed directly *over another*, or in some *other Posture*, wherein both could not naturally have grown: Whether in any *Marsh* there be found *only the Roots*, without the *Trunks* of the Trees, or the *Trunks alone*, but *no Roots*: Whether either *Trunks*, or *Roots*, when

when first taken forth of the Earth, have any *Marks* or *Signs* of human *Workmanship* upon them, appearing to be cut with an *Ax*, or *Saw*, or there be any *Cinders*, or other Evidence of Fire, evincing that Part of them hath been *burnt*.

10. BY what *Means* do these Trees, and other Bodies seem to have been *re-posed* in that Manner; and what are the *Opinions* of the Persons employ'd in digging the Peats, and of the near *Inhabitants* concerning them.

APPENDIX III.

Of Mountains, Rocks, and Cliffs:

I. **O**BERVE the *Bigness* and *Height* of the Mountain; what *Grottoes* are in it; what *Springs* arise upon it, and in what *Part* of it they are; as also, what *Rivers* or running Waters have their Sources in it; and what *Quantity*

city of Water they discharge Summer and Winter.

2. IF by Means of any *Fall of Earth* from it, the Mountain, Rock, or Cliff be laid *bare*, and its Strata exposed to View, or by the repeated *Battery of Rains*, or the Violence of the *Sea*, digging for Stone, Marble, or the like, observe, 1. the *Posture* of the Strata, whether *Horizontal, inclining, or erect*; also their *Thickness, Consistence, and Fissures*. 2. The several *Sorts of terrestrial Matter* of which each consists, recounting them in the *Order* they lye. 3. What *Metallick or Mineral Matter* they contain. 4. What *Shells, Teeth, or other extraneous Bodies*.

3. SEARCH carefully in all Places for *Shells*, and other *Marine Bodies*; but more especially at and near the *Tops and highest Parts* of Rocks and Mountains.

4. ENQUIRE whether the *Tops* of the higher Mountains and Rocks do not emit *Vapours* in great Plenty, or there

be not a *Cloud* hovering upon them before, or during the Time of *Rain, Hail, Snow, Wind, Storms, Thunder,* or other tempestuous *Weather*: Whether from the Manner, Colour, Bigness, Duration of the Cloud or Vapours, any *Pre-sage* may be made *what sort* of Weather, e. gr. whether Wind or Rain will ensue; or of *what Continuance* it will be; whether the said Cloud or Vapours appear upon Change of Weather *constantly*, or only at *some Times*. 'Twere much to be desir'd, that some *Person* living in View of such Mountains, would keep a *daily Register* of the *Weather*, and at the same Time of all the *Phænomena* of the said Cloud or Vapour; and if he be in View of two or more such Mountains, at once, that he extend his Observations to all of them.

5. WHETHER ever there be any extraordinary *Eruptions* or *Discharges* of *Water* in considerable Quantity, out of those Mountains.



APPENDIX to Page 107 *supra*, containing more full, explicit and particular Instructions for making Observations concerning Fogs, Mists, or Clouds, seen frequently upon the Tops of high Hills or Mountains.

1. **O**BERVE whether these Fogs arise out of the Hill; or whence otherwise do the Vapours that constitute them proceed.

2. **W**HETHER they be seen hovering over the Top of one only Hill, or of more.

3. **W**HETHER the Fog on the several Hills first appear at the same Time on each, increase in equal Proportion on all, and decrease likewise on each at the same Time.

4. WHETHER these Fogs be constant Forerunners of Rain; so that it never happens either in Summer or Winter, unless they appear before; and whether Rain always follows whenever such Fogs appear.

5. OBSERVE how long they appear before the Rain falls.

6. WHETHER any Judgment can be made by View and Observation of these Fogs, of the Quantity or Duration of the Rain; or whether it will be attended with Storms of Wind, or by Thunder and Lightning.

7. WHETHER the Rains that fall, seem to proceed from the Fog gradually diffusing it self, and overspreading the Country.

8. WHETHER the Barometer constantly fall at such Time as the Fog rises, and in Proportion to the Quantity of it, and
rise

rise again at such Time as the Fog is dispersed and withdrawn.

APPENDIX to Page 101 *supra*, containing more particular Instructions for making Observations concerning *Præsesages* of Rain in deep Mines, great Quarries or Coal-Pits.

1. **O**BERVE whether Wind, Rain, Thunder or Lightning can be foretold before they happen, by any Vapours, Steams, or Exhalations in the Mines, Quarries, or Pits.

2. **W**HETHER it can be distinguished by the Manner, Colour, or Constitution of the Vapour that shall ensue, whether Rain, Wind, or Thunder.

3. **W**HETHER Judgment can be made of the Quantity and Duration of the Rain or Wind, by the Thickness of the
Vapour,

Vapour, the Continuance of it, or any other Way.

4. *WHETHER* the Vapour consists simply of Humidity ; or is also charged with metallick or mineral Steams.

5. *WHETHER* Rain constantly ensues as often as these Vapours discover themselves in the Mines, and the Vapours constantly forerun and appear before Rains.

6. *OBSERVE* how long the Vapours discover themselves before the Rain falls.

7. *WHETHER* these Vapours be observed only in some, or in all Mines indifferently ; and whether they rise at the same Time in all, so far as Intelligence can be obtain'd.

8. *WHETHER* they are attended with any unusual Heat.

9. *OBSERVE* wherein these Steams differ from those called Damps ; or whether

ther Damps greater or less, and Rain, constantly attend each other.

10. OBSERVE how the Barometer and Thermometer, as well those kept in the Mines, as those above Ground, are affected during the Ascent of the Steams and Damps, and during Rain; as also before and after.





NUMBER IX.

*An Addition to the second Part
of the Essay towards a Natural
History of the Earth.*

THE *Confectaries* of the former Part of this *Discourse* are all *negative*; that being only introductory, and serving but to free the Way to this *second Part*; to rescue the Enquiry from the *Perplexities* that some *Undertakers* have *incumber'd* it withal; and to set aside the false *Lights* they used in Quest of the *Agent* which transposed these *Sea-Shells* to *Land*.

Now, the only *sure Lights* we have to conduct us in the *ascertaining* this *Affair*, are *History of Fact*, and *Observations*. So that I shall give here some *Intimation* of the *Chief* of *those* that serve to clear up *this Subject*, and bring the
Thing

Thing in Question to a fair *Decision*. These are, That the *Earth*, all round the *Globe*, appears, wherever it is laid open, to be *wholly composed of Strata*, lying on each other, in Form of so many *Sediments* fallen down successively from *Water*. That, accordingly, those *Strata* that lye *deepest*, are ordinarily the *thickest*: and those that lye *above*, gradually *thinner*, quite up to the Surface. That there are *Sea-Shells*, and *Teeth* and *Bones of Fishes*, found *reposit*ed in these several *Strata*; not only in the more lax, *Chalk*, *Clay*, and *Marle*, but even the most solid *Stone*, and the rest. That these *marine Bodies* are *incorporated* with the *Sand* that constitutes the *Stone* of these *Strata*, in such Sort as together to *compose one common Mass*. That on breaking up this *Mass*, so as to part the *Shell* from the *Stone*, *this* is ever observ'd to have receiv'd an *Impression* of the *exterior Surface* of the *Shell*, so exact as to shew it had been *contiguous* and *apply'd* to *all Parts* of the *Shell*; which the *Stone* could not be capable of, had it not been then in a *State of Solution*, the

Matter whereof it consists *loose*, and susceptible of *Impression*. That, upon breaking the *Shells*, and examining the *Insides* of them, they are found to contain in them *Stone*, commonly of the same Kind with that without, which the *Stratum* is made up of, and *apply'd* as exactly to the *Insides* of the *Shells*; so as to have taken the *Impression*, and all the *Lineaments* of them, after the Manner of Matter *cast*, soft, or melted in a *Mould*. That the *Shells* are as frequently *immers'd* in the *Substance* of the *Mineral* and *Metallic Nodules*, even the most firm and solid, *Flint*, *Spar*, *Pyritæ*, and the rest; the Matter of these *Nodules* exhibiting the *Lineaments* and *Impressions* of both the *Outsides* and *Insides* of the *Shells*, as truly as the *Stony Matter* of the *Strata* does. That these *Marine Productions* are thus *repositèd* as well in the *lowest Strata*, as in the *uppermost*; at the *Bottoms* of the *deepest Mines*, as to the very *Tops* of the *highest Mountains*. That they are observ'd in some Places in such *Multitudes*, as in Bulk and Quantity, to *equal*, if not *exceed* the

Sand,

Sand, or other *terrestrial Matter* of the *Strata*. That there are ordinarily digg'd up, amongst the rest, *Shells* that are of *foreign Origin* and *Extract*; being *not the Product* of the *Neighbouring Seas*, but of *Seas* much *remote*, and at great *Distance*. Thus we here in *England* discover, frequently at great *Depths*, *Shells* of *Fish*, very numerous, and of different *Kinds*, that appear now living on the *Coasts* of *Peru*, and other *Parts* of *America*. That there are likewise *discover'd* commonly at *Land*, and in the *Bowels* of the *Earth*, *Shells* that are not at this *Day* found *living* on any *Coasts*; being doubtless such as naturally reside and inhabit only in the *deepest* and most remote *Recesses* of the *Main Ocean*, without ever now approaching near any *Shore*, or being consequently ever seen. That, in *all Parts* of the *Earth*, as well in *Asia*, *Africa*, and *America*, as in *Europe*, as well in *Countries* the most *Distant* from any *Seas*, as those that lye *near* to them, the *Strata* are compil'd, and the *Marine Bodies* dispos'd in them, every where after the very *same Method*;

and so, as apparently to shew *Things* were reduced into this *Method* in *all Countries*, at the *same Time*, and by the *same Means*. That there are also lodg'd in the *Strata*, *Bones*, *Teeth*, and other Parts of *Quadrupedes*, or *Land Animals*, and oftentimes of such as are *not Natives* of the *Country* in which they are thus found. Particularly here in *England* we dig up the *Tusks*, and the *Grinder-Teeth*, the *Bones*, yea, whole *Skeletons* of very great *Elephants*; and likewise incredible large *Horns* of the *Moose Deer*, a Creature not known to be *now living* in any other *Country* excepting *America*: As also, sometimes Shells of *Tortoises*, peculiar to the same *Country*. That there are besides, repositied in *Stone*, and even in the firmest and hardest *Strata*, Leaves of various Kinds of *Vegetables*: and sometimes whole *Trees*; as also such *Fruits* as are durable, firm, and capable of being preserv'd, *e. gr. Nuts*, *Pine-Cones*, and the like. That, amongst the rest, there are discover'd, under Ground, *Trees*, *Leaves*, and *Fruits* of *Vegetables*, in *Countries* where such do
not

not now spontaneously grow. Nay, that there are digg'd up *Trees* in great *Numbers*, and many of them very *large* in some *Northern Islands*, in which there are at this Day *growing* no *Trees* at all; and where, by reason of the great *Bleakness* and *Cold* of those *Countries*, 'tis probable none ever did, or could grow. That, of all the various *Leaves* which I have yet seen thus lodg'd in *Stone*, I have observ'd none in any other State, nor Fruits further advanc'd in *Growth*, and towards *Maturity*, than they are wont to be at the latter End of the *Spring Season* *. That the squamose Covers of the *Germina* or Buds, and the Shives or Chaff of the *Juli Trees* and *Shrubs*, that fall off in the Spring, and are found in so vast Quantities in many Peat-Marshes, apparently point forth the *same Season*. As do likewise the immense Sholes of the *Ova* of *Fishes*, so frequent
in

* *When*, according to the *Mosaic Relation*, the *Water* of the *Deluge* came forth, and put a *Stop* to the *Growth* of both *Animals* and *Vegetables*. Confer *Part 3. Sect. 2. Conf. 5.* and *Part 6.* towards the End.

in the upper *Strata* of *Stone*. That the *Shells* of the *Young* of *Fish* of the *current Year*, wherever digg'd up, are of the *Size* and *Bigness* they are used to arrive to at *that Season*. That of all the many *Flies* and *Insects*, that I have yet seen inclos'd in *Amber*, I have never observ'd any that were not of the *vernal Tribes* and *Kinds*.

THESE are the main *Observations* whereon I ground what I offer in this second Part of the *Essay towards a Natural History of the Earth*.





A

Mineral Dictionary ;

O R

An alphabetical

I N D E X

*Of the Names of all Kinds of Fossils,
referring to the Pages of this Work,
wherein each is explain'd.*

	A.		'Αμμος	Page 5
A	Damica	Page 4	Antimony	43
	Agarico minerale.		Arena	9
	F. Imperati	4	Argilla	2
Agate		21	Armeniac Bole	2
Alabaster		11	Armenus Lapis	3
Alum		37	Aqua Marina	30
Amethyft	29.	33	B.	
Amber		39	Balafs-Ruby	29
			Bar-	

Barbadoes-Tar	P. 38	Diaspro-Roffi	P. 19
Belemnites	p. 58 Part 2.	Drop-Stones	18
Bitumen	39	E.	
Black Earth	4	Earths	1, 2, 3, 4
Black-Lead'	43	Earth-Flax	14
Blood-Stone	20	Elfs. Earth-Scrip	16
Bole Armeniac	2	Emerald	30, 33
Boulder-Stones	13	Emery	10
Button-Stone	17	English Talc	14
	C.	F.	
Cat's Eye	21	Fairy's-Water-Bottle	16
Cat-Silver	14	Flag-Stone	9
Cauk	18	Flints	21
Chalk	4	Flinty-Eagle-Stone	16
Calamin	43	Fossil-Salt	35
Calcedony	22	Fossil acid Salt	37
Cannel Coal	39	Free-Stone	9
Carbuncle	29	French-marking-Stone	3
Cerauniæ	p. 24 Part 2	Fullers Earth	2
Chrysolite	30	G.	
Cryſtal	30	Galaxia	3
China-Earth	3	Garden Earth	4
Cimolia purp.	2	Garnet	28
—Alba	2	Gialolina	4
Clay Common	4	Glarea	5
Cærulea Terra	3	Glimmer	14
Cœruleus Lapis Merreti	3	Gold	44
	3	Granite	11
Clay-Stones	13	Gravel	5
Cobalt	43	Grind-Stone	9
Copple-Stones	12	H.	
Copper	44, 49	Hone	10
Coralloid Bodies	17, 76	Honey-Comb-Stone	17
	Part 2.	Hyacinthus	28
Craye de Brianſon	3	I.	
Creta	4	Jacinth	28
Croyl-Stone	18	Jasper	20
	D.	Jeat	39
Diamond	32, 34	Iron	44, 50
		Killoia	

		Native yellow Arsenick	
K.		<i>ibid.</i>	
Killoia molliuscula	P. 3	Native red Arsenick	41
Killoia duriuscula	3	Nephritic Stone	19
Killow the softer	2	Nitre	36
—harder	3	O.	
Knots	13	Ochra	4
Knurs	13	Ochreous Eagle-Stone	16
L.		Oculus Beli	22
Lac Lunæ. Ol. Wormii	4	Oil-Stone	10
L'azure	19	Onyx	22
Lead	44, 54	Opal	21
Lemnian Bole	2	Ophites	11
Leucographis	3	Osteocolla	18
Lime-Stone	90	P.	
Loam	4	Parget	14
Lutum	4	Pebles	21
M.		Petroleum	38
Magical Gems 24 Part	2	Piped-Waxen-Vein	15
Malachite	19	Piffasphalton	39
Maltese-Earth	3	Pit Coal	39
Marble	11	Polishing-Stone	10
Marcasite	42	Porphyry	11
Marga	4	Potters Clay	2
Marl	4	ψάμμος	5
Melitenfis Terra	3	Pseudo-Topasius	33
Mill-Stone	9	Pseudo-Berillus	<i>ibid.</i>
Mineral-Bezoar	15	Pseudo-Sapphirus	<i>ib.</i>
Mochon-Stone	22	Pseudo-Smaragdus	<i>ib.</i>
Morochites	3	Pyrites	42
Morochthus	3	R.	
Mould	4	Rag-Stone	9
Muscovy Glass	17	Rock Ruby	29
Musroom-Stone	17	Root of the Emerald	19
N.		Rotten-Stone	3
Naphtha	38	Rubble Stones	12
Natron	36	Rubrica duriuscula	3
Native Mercury	40	Rubrica molliuscula	2
Native Cinnabar	41		

Ruby	33	Terre-Bleue	3
Ruddle the softer	2	Terra Melitenfis	<i>ib.</i>
— the harder	3	— Sinensis	<i>ib.</i>
S.		Terra flavescens	4
Samian Bole	2	Terra nigella vegetabi-	
Sabulum	5	lis Dædala	<i>ib.</i>
Sal Ammoniac	35	Terra rubella	<i>ib.</i>
Sand	5	Terra miscella	<i>ib.</i>
Sand-Stone	9	Thunder-Bolt	17
Salamander's Hair	14	Tin Glafs	43
Sapphire	29, 33	Tin	44, 52
Sardonyx	22	Tobacco-Pipe Clay	2
Selenite	17	Touch-Stone	10
Silver	44, 48	Tripoly	3
Slate	10	Topaz	28, 33
Smitt	2	Trincal	35
Soap-Earth	3	U. V.	
Spar	17	Virgin Quicksilver	40
Spaad	14	Viridis Terra	3
Spinell-Ruby	29	Vitriol	37
Star Stone	17	Ultramarine	20
Stelechites	17	Umbre	4
Steatites	3	Umbria	4
Steinomarga	4	W.	
Sony Iceicle	18	Wad	43
Stony Nodules	13	Water-Saphire	29
Stony Comfets	18	Waxen Vein	15
Stone Weapons 24. Pa. 2.		Whet-Stone	9
Sulphur	37	White Saphire	32
T.		Y.	
Talc	14	Yellow Ochre	4
Terra Cariosa	3	Z.	
Terra Tripolitana	<i>ibid.</i>	Zink	43
Terre-Verte	<i>ib.</i>	Zoica	4



INDEX of Things occasionally treated of in these Papers.

THE Author's Conduct in ranging natural Fossils <i>Pa.</i> 23	—Destroyed at the Deluge 41
Arrow-Heads 43	Iron, its use recovered in <i>Asia</i> <i>ibid.</i>
First Module from <i>Babel</i> <i>ibid.</i>	Thence pass'd into <i>Europe</i> <i>ibid.</i>
Babel built of Brick 44	<i>Americans</i> taught the Use of it by the <i>Spaniards</i> 40
Brontia 10 <i>L.</i>	Magical Gemms 26
Bucardites 9 <i>L.</i>	Petrify'd Shells 24
Bufonitæ 13 <i>L.</i>	Plectronita 13
Belemnites described 58	Pumex 20 <i>L.</i>
Coralloids digg'd up at Land described 76	Pyramid of <i>Ægypt</i> 44
Cornu Ammonis 9 <i>L.</i>	Marine Bodies in the Stone of it 52
Directions for registering Fossils 46	Selenites 35
Fossil Urns 26	Siliquastrum 14
Fossils extraneous and native <i>p.</i> 8 <i>Letters.</i>	Stone Weapons 37
Glossopetræ 13	—in use at this Day 40
Hammites 18	Lapis Spangiac. 20
Hysterolithus 10	Star Stones 32
Ichthyospendyla 15	Trochi, &c. 12
Iron Instruments in use before the Deluge 41	Turcois described by <i>Pliny</i> 17 <i>Letter.</i>
	Urim and Thummim 36

F I N I S.

BOOKS printed for WILLIAM INNYS.

J. Raii Synopsis Methodica Stirpium Britannicarum tum Indigenis tum in agris cultis locis suis dispositis, additis generum characteristicis, specierum descriptionibus & Virium Epitome. Editio 3^{tia} multis locis Emendata & 450 circiter speciebus noviter detectis aucta, cum Iconibus. 8^o.

—Synopsis Method. Avium & Piscium cum fig. 8^o.

—Synopsis Method. Animalium Quadrupedum & Serpentinae Generis. 8^o.

—Methodus Insectorum.

A Natural History of English Insects, with 100 Copper-plates coloured after the Life, by *E. Albin*, to which are added large Notes, and many curious Observations by *W. Derham* F. R. S. 4^o.

Physico-Theology, or a Demonstration of the Being and Attributes of God from a Survey of the Creation. By *W. Derham*. The 6th Edition, 8^o.

Three Physico-Theological Discourses concerning,

I. The primitive Chaos and Creation of the World.

II. The general Deluge, its Causes and Effects.

III. The Dissolution of the World, and future Conflagration, wherein are largely discuss'd the Production and Use of Mountains, the Original of Fountains, of formed Stones, and Sea Fishes, Bones and Shells found in the Earth, &c. By *John Ray*, late Fellow of the Royal Society. The 4th Edition, 8^o. with Copper Plates.

Cyclopædia, or an universal Dictionary of Arts and Sciences, containing the Definitions of the Terms and Accounts of the Things signify'd thereby in the several Arts both Liberal and Mechanical, and the several Sciences Human and Divine: The Figures, Kinds, Properties, Productions, Preparations and Uses of Things natural and artificial: The Rise, Progress and State of Things Ecclesiastical, Civil and Commercial, with the several Systems, Sects, Opinions, &c. among Philosophers, Divines, Mathematicians, Physicians, Antiquaries, Criticks, &c. The whole intended as a Course of Antient and Modern Learning, compiled from the best Authors, Dictionaries, Journals, Memoirs, Transactions, Ephemerides, &c. in several Languages, in 2 Volumes. By *E. Chambers* Gent.

